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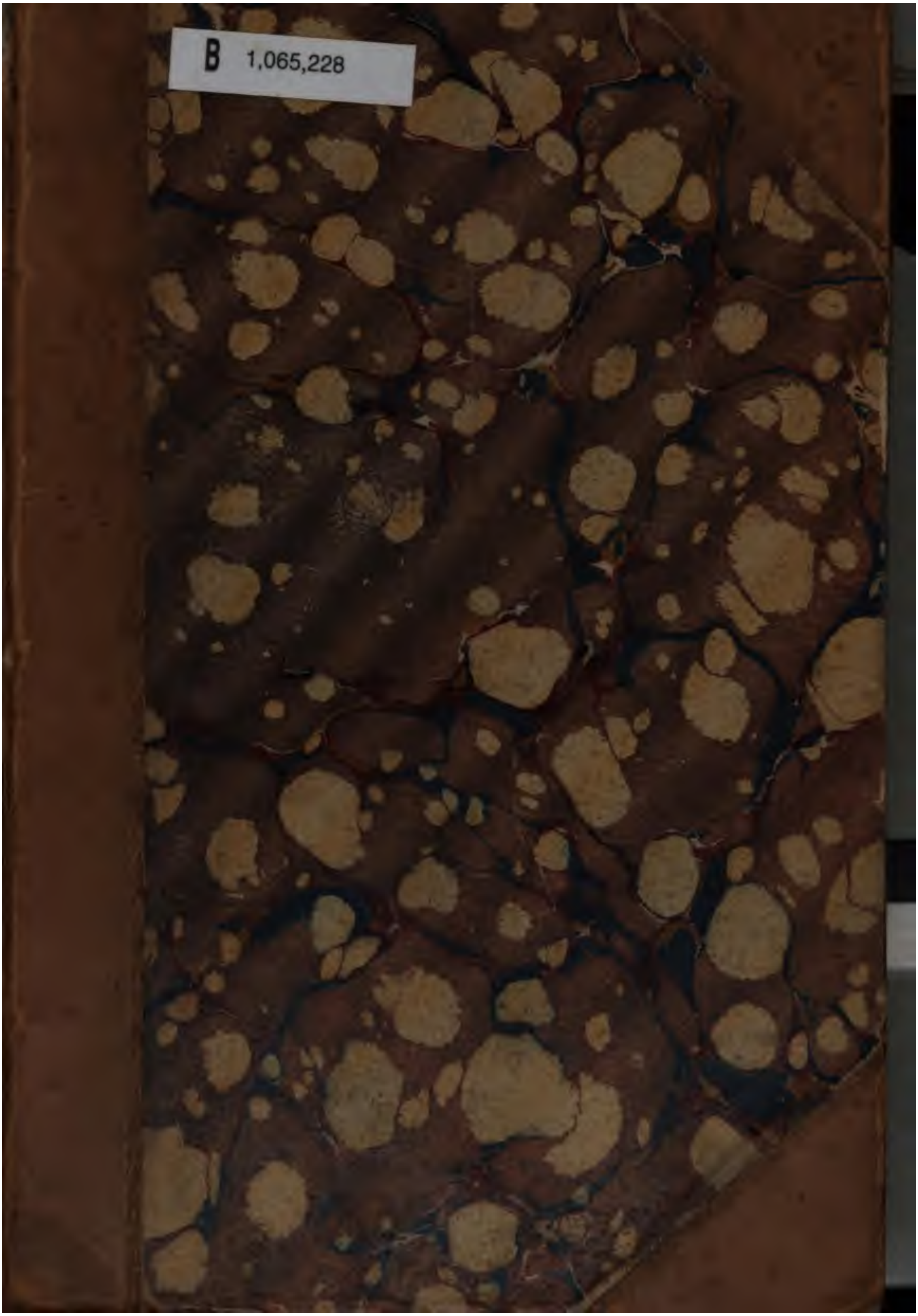

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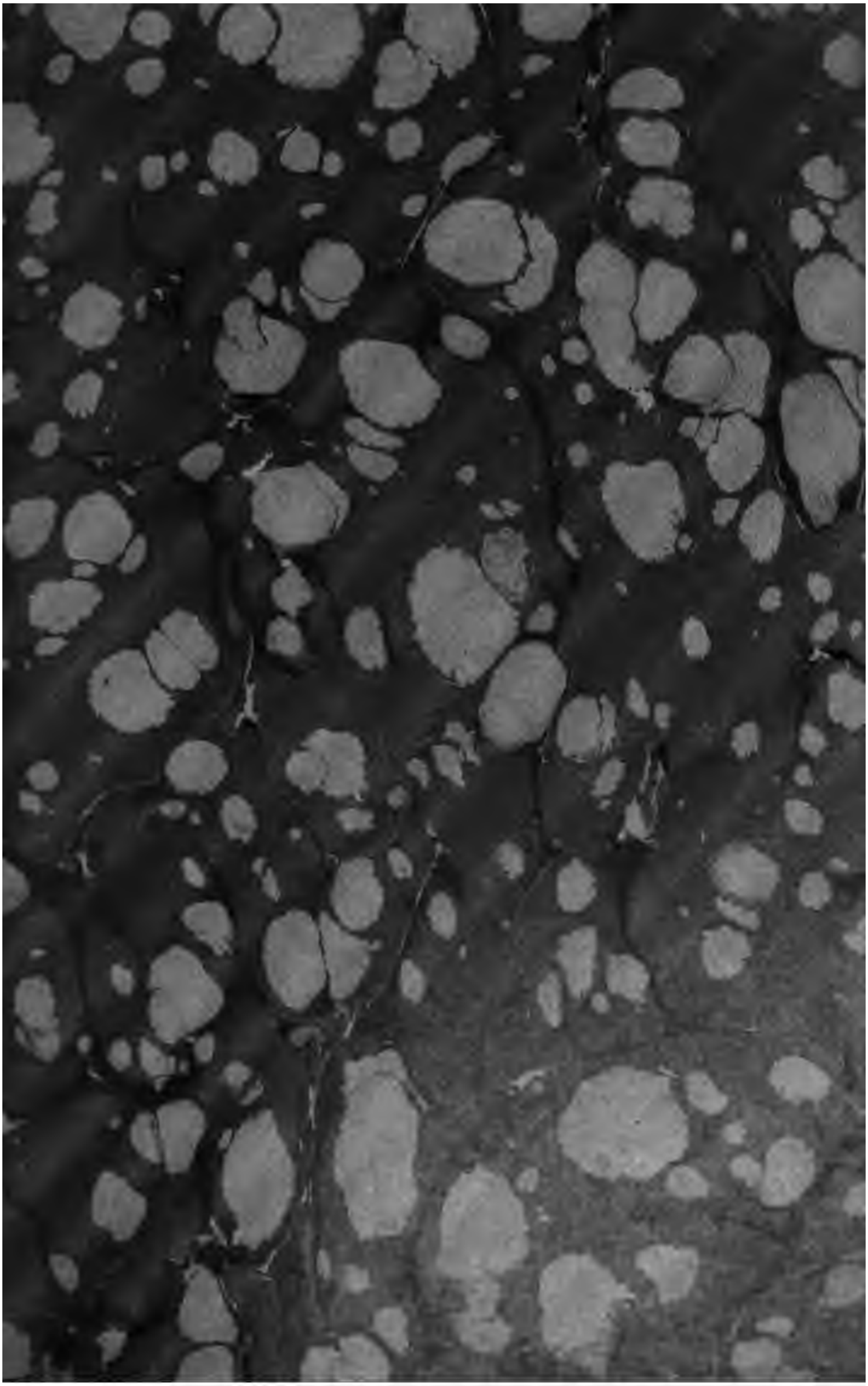

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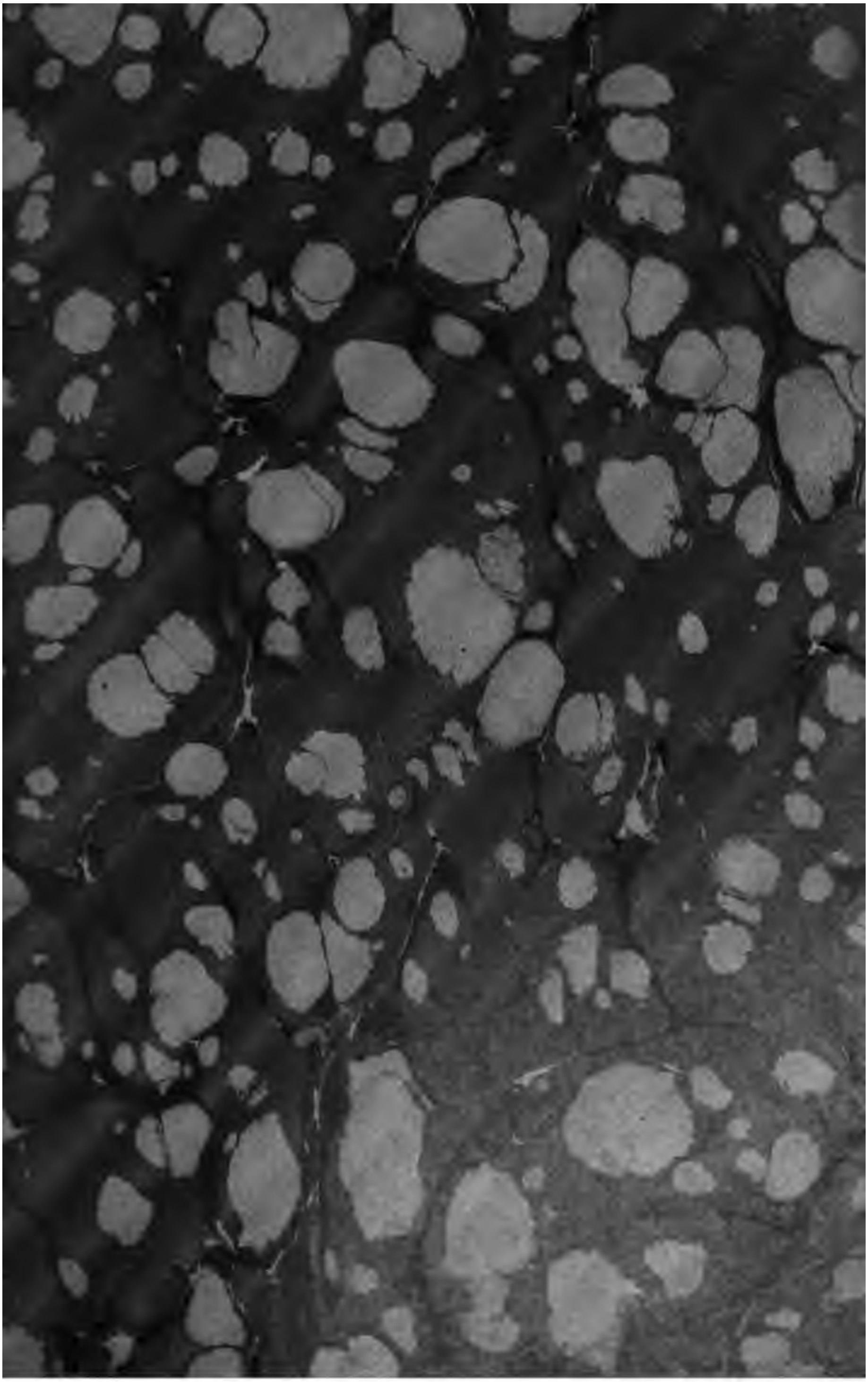

# PAPERS & PROCEEDINGS

OF THE

# ROYAL SOCIETY

OF

# TASMANIA,

FOR THE YEAR

## 1902.

(ISSUED JUNE, 1903.)

Tasmania:

PRINTED BY DAVIES BROTHERS LIMITED, MACQUARIE STREET, HOBART.

1903

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The responsibility of the Statements and Opinions given in the following Papers and Discussions rests with the individual Authors; the Society as a body merely places them on record.

# Royal Society of Tasmania,

Hobart, Tasmania.

Those persons who are inclined to benefit the Society by legacies are recommended to adopt the following

## Form of Bequest.

I give and bequeath unto the "Royal Society of Tasmania" the sum of £ such legacy to be paid out of such part of my personal estate, not specifically bequeathed as the law permits to be appropriated by will to such a purpose.

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President of the Royal Society of Tasmania..

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# Royal Society of Tasmania.

## ABSTRACT OF PROCEEDINGS, APRIL 29th, 1902.

A meeting of the Royal Society of Tasmania was held on Tuesday evening, April 29, 1902, in the society's new room, Argyle-street. The President, His Excellency the Governor, Sir Arthur Havelock, G.C.S.I., G.C.M.G., presided. The Governor was accompanied by Lady Havelock and Captain Gaskell, A.D.C.

### Welcome to the New President.

The Hon. Nicholas J. Brown, Speaker of the House of Assembly, and Vice-President of the Royal Society, said he was charged with a duty of a very pleasant character. He had, on behalf of the Fellows of the Royal Society, to welcome His Excellency on that, the first, occasion of his presiding at a meeting of the Fellows. According to the charter of the society, the representative of His Majesty the King was, ex officio, President of the Royal Society of Tasmania, a privilege which, he believed, was not included in the charter of any other Royal Society in Australia. They knew, from ample evidence, since His Excellency's arrival in Tasmania, that he took a very warm and sympathetic interest in the welfare of this State, and the Fellows of the society hoped that His Excellency would derive pleasure from his association with that society. They felt confident the society would derive great advantage, encouragement, and assistance from His Excellency's association with the society from time to time. He desired briefly to allude to a few instances in the past history of the society. In the early days of its existence, considerable difficulty arose regarding land for its use. One Government after another promised land, but a great deal of correspondence took place, and a few years ago they found that their title to a portion of the land supposed to be obtained was doubtful. The records of the society were searched, and a statement was prepared, showing beyond all doubt, that while it was the general intention to grant the society a large block of land, including Franklin-square, ultimately the land given was confined to the block between Macquarie - street and Davey-street, now occupied by the society. Their title to that large area of land was now assured, but he desired to refer particularly to a letter found in the correspondence written by the early secretary, in which he spoke of the necessity for ample space being reserved to the society. He said the society "must be cumulative and expansive beyond any limit they could assign to it." The Fellows had done very well so far. They had got natural history specimens, and a fairly good representation of art, and, on the whole, he thought the institution would compare favourably with any institution in the other States. But they could say now, as the secretary said in 1857, that the society must be cumulative and expansive beyond any limit they could assign to it. Its first expansion now should be in the direction of the securing and equipment of a Technological museum. That seemed to be necessary, in view of the anticipations that, in the near future, Tasmania would become an important manufacturing and distributing centre for the whole of Australia. Technical instruction was being imparted in our schools and he hoped that technical knowledge would progress. But a Technological museum was a very important thing to have at our command. While welcoming His Excellency to the Royal Society, he ventured to express a hope that, while it was certain that the present moment was not an opportune one at which to discuss heavy expenditure, yet they believed the present difficulties would roll away, and that His Excellency's tenure of office, as Governor, and as President of the Society, might be signalised by the addition of a Technological museum to the National Museum of Tasmania. He extended to His Excellency a very cordial welcome on behalf of the Fellows of the Society. (Applause.)

His Excellency the Governor said he begged the Fellows to accept his very sincere thanks for the extremely kind terms which they had extended to him. He felt proud to occupy the chair which had been occupied by John Franklin, William Denison, and Robert Hamilton. (Applause.) He was unprepared for the suggestion that was thrown out by the Vice-President, but (for the short time he had had to reflect upon it) it seemed to be one that deserved consideration. He trusted that before his time was over, the idea might be carried into practice. He thanked them once more for their kind welcome, and they would now proceed to the business of the evening. (Applause.)

### New Fellows.

Major R. C. Lewis, D.S.O., and Dr. R. R. Whishaw, and Mr. Horace Watson, were elected Fellows of the society.

appropriated to the exhibition of objects and trophies, which will show to advantage specimens of the products of the Tasmanian mines and of the timber and cabinet woods found in the State. Photographs, by the artistic hand of Mr. Beattie, in number about six hundred, representing the beautiful scenery of Tasmania, have been hung on the walls of this room. The Museum and the Art Gallery now form institutions of which Tasmania may be justly proud, and with which, as a means of illustrating and bringing into notice the resources, the attractions, and the progress of Tasmania, and as a means of cultivating our taste for what is beautiful and elevating, we may well be satisfied.

Mr. Vice-President and members of the council, ladies and gentlemen,—I think you will concur with me in the gratifying opinion which I venture to express, that the Royal Society has, in co-operation with the Board of Trustees of the Museum, worked well during the past year, towards their combined purpose, of promoting science, art, and the progress of the country. I trust the sessional year of the Royal Society, which begins to-day, will, at its close, show equally good results.

## Late Sir J. Agnew.

Col. W. V. Legge, R.A., moved,—"That in the further recognition of the valuable services rendered by the late Sir James Agnew to the Royal Society of Tasmania and to the community generally as a liberal patron of art and science, a subcommittee of the council be appointed to draw up an obituary notice to be published in the Society's Transactions of 1901; such committee to consist of the Hon. N. J. Brown, Messrs. Thos. Stephens, M.A., R. M. Johnston, F.S.S., and the mover."

Mr. A. G. Webster seconded the resolution, which was agreed to.

## Papers.

### Graptolites in Tasmania.

Professor E. G. Hogg, M.A., read a paper by Mr. T. S. Hall, M.A., Melbourne, on "Discovery of Graptolites in Tasmania."

A brief discussion upon the paper followed, in which Mr. R. M. Johnston and Professor Hogg took part.

### "Tasmania as a Manufacturing Centre."

By Mr. R. E. Naghten B.A.

The advent of federation, and the consequent abolition of intercolonial duties, are bringing about new conditions, which are well worth the attention of the British manufacturer or capitalist. Of no part of the Commonwealth is this truer than of Tasmania. In the first place, Tasmania possesses, in a superabundant degree, what is conspicuously wanting in all the other federated States, namely, water power. To this must be added the fact that, owing to the peculiar configuration of the island, this water power can be utilised at the mouth of the Derwent, on which Hobart, the capital, is situated; in other words, this water power is available in conjunction with one of the finest natural harbours in the world. To get some idea of the natural features of the island which bring about this resultant water power, Tasmania may be compared to an inverted and slightly elongated basin. From the very coast inwards the whole island is mountainous, and these mountain ranges culminate in a vast plateau in the midlands, where the large annual rainfall is stored in the natural reservoir of the lake district. These mountain ranges, covered in many places with vast indigenous forests, attract the atmospheric moisture which the neighbouring continent of Australia, owing to its flat and monotonous landscape, is unable to retain, and from this high plateau the water so accumulated descends by one or other of the natural courses to the coast line in a series of abrupt falls in a comparatively short space, in a manner that seems almost ideal for the best development of water power. For instance, the Dee river, which is the natural outlet of Lake Echo, starts at a barometrical altitude of 2,975 feet, and the total fall in the short distance of 27 miles is 2,675 feet. (N.B.—The height of the Great Lake, 3,350 feet, and that of Lake St. Clair 2,500 feet above the sea.) Report by K. L. Rahbek, Mem. Dan. Assoc. C.E. An interesting professional report on the possibilities of the water power that is available from three of the central lakes, namely, Lake St. Clair, Lake Echo, and the Great Lake, has lately been presented to the Tasmanian Houses of Parliament. From this report it appears that the horse-power probably available from these three lakes amounts to a total of 82,000 actual horse-power, represented by 46,000 from Lake St. Clair, 9,000 from Lake Echo, and 27,000 from the Great Lake. In this connection Mr. Rahbek says:—"It must be borne in mind that by obtaining the power as specified, I have not in any way prejudiced the irrigation question; in fact, it has helped to solve it, inasmuch as I have made provision for giving ample compensation water for all irrigable lands for the parts of the rivers where water will be drawn for power; and below the terminal power-stations all the water is available for any purpose, and will be forwarded in a steady stream all the year round . . . . . In case it should be possible to make Hobart the manufacturing centre of Australia, amongst other reasons, on account of her facilities in producing inexpensive and reliable power, the 82,000 horse-power at the different power-stations would be reduced by about 30 per cent, namely, by converting the mechanical energy into electric force, by friction and loss on line from power-stations to Hobart, and by reconverting the electric current into mechanical energy; and the power which could be distributed at Hobart would be, say, 57,000 actual horse-power. At present there is not one thousand horse-power consumed in Hobart for tram service and for lighting, but it is a true maxim that 'supply creates demand,' and if an inexpensive and plentiful supply of electric force was offered here the demand would increase; perhaps, under such conditions, Hobart itself might absorb from 5,000 to 7,000 horse-power, and 50,000 horse-power would be available for large manufacturing industries. . . . . Judging by the rapid strides which have been made during the last few years by electrical engineers and manufacturers, it is more than probable that within a few years it will be practicable and profitable to run all the Tasmanian railways, to supply light all over the island, to run all motors as well in the mines as anywhere else within this island by electric power, derived from water, but all this cannot be accomplished to-day." The water power mentioned in this report is that derivable from three only of the central lakes, and does not by any means exhaust the power available in other parts of the island; but enough has, perhaps, been said to give some idea of the vast quantity of water available, and of its value for commercial purposes. But water power is only one factor in the new situation. Even before federation, in spite of hostile tariffs, the manufacture of woollens in Hobart and Launceston was a growing industry. Partly owing to the climate, and partly owing to the excellence of the water supply, the local manufacturers were able to do an increasing export trade, even with the "protective" colony of Victoria, and notwithstanding her 25 per cent. duty. With the proper utilisation of water power (which has hitherto not been turned to account), and with the abolition of inter-colonial duties, there seem good reasons for anticipating that Tasmania will become a great manufacturing centre for woollens. Australia, the great wool-producing country of the world, lies at her very doors, and for fiscal purposes now forms part of the same community; and there seems little doubt that, as a purchaser of the raw article, the county of Yorkshire will in future find a formidable competitor in the colony of Tasmania. For at least fifty miles in a south-westerly and a south-easterly direction, each way from Hobart, the southern part of the island is pre-eminently suited for the establishment of "power" factories. From Hobart to Norfolk Bay on the one hand, and from Hobart to Franklin (situated in the Huon river) on the other, there is an uninterrupted stretch of deep yet completely sheltered water, which combines the advantage of a gigantic natural dock with the beauties of a lake. Along almost any part of these shores land can be obtained at practically "prairie value," which would be eminently suitable for the establishment of factories—that is to say, with deep water frontage, from which the manufactured article could be sent to the several Australian States by the cheapest of all means of transit, namely, water carriage. A greater contrast to the manufacturing centres of the Yorkshire woollen trade can hardly be imagined than these sheltered bays, with their forest-covered hills running almost down to the water's edge. At the present time the Channel (as the long and sheltered passage between the Island of Bruni and the mainland is termed) and the Huon river, whose waters flow into this channel's southern extremity, are chiefly known as a delightful roving-ground for tourists, and as a centre for the small fruit and apple trades. But it is at least within the bounds of reasonable probability that within the next twenty years these beautiful bays and quiet inlets, where the sea is calm, peaceful, and sheltered as a lake, may be resounding with the busy clang of machinery, though, fortunately, owing to the energy being derived from water power, there is no fear of the peculiar brightness of the atmosphere being marred by the volumes of smoke that cast a pall over the chief manufacturing centres of Yorkshire. There are at least three other industries which must make enormous strides with the advent of federation. It has already been incidentally mentioned that the valleys of the Channel and the Huon are the centres of the apple trade. In the past that industry has been seriously handicapped by the protective tariffs of the other colonies, with the single exception of New South Wales, and the duties thus imposed, added to such an appreciable extent to the price which had to be paid by the consumer, that only the wealthier classes were able to afford what, under these circumstances, became a luxury. But the moment that these hostile tariffs are removed the market expands automatically, and consists of four millions instead of about one million consumers; while the bulk of these four millions live in a climate which makes the consumption of large quantities of fruit almost imperative. Almost precisely the same remarks apply to the timber and the beer trades. The Tasmanian blue gum (Eucalyptus globulus) and the stringy bark (Eucalyptus obliqua) are amongst the most valuable hardwood timbers of the world, and, even in the teeth of an almost prohibitive tariff, a certain quantity was always exported to the mainland, chiefly owing to the fact that the timber country is in close proximity to water carriage, and the handling and transport were, in consequence, comparatively economical. Now, with the abolition of the tariff, the demand must enormously increase, and when once a proper system of re-afforestation is introduced, Tasmania must gain enormously and permanently from her wealth of forest lands. Lastly, it has been found that, owing to the temperate character of the climate and the excellence of the water supply, the beer which is brewed in Tasmania is very superior to the article produced on the mainland. Even before federation there was a considerable export; and now that the whole of Australia is open to the Tasmanian brewer, there seems every reason to believe that the brewing industry of Australasia will inevitably gravitate to the place where the climatic and general conditions are favourable to the production of the most superior article. In a brief sketch of this description it is impossible to do more than outline the new commercial tendencies which are at work in this part of Australasia, but enough has, perhaps been said to show that, under federation, the island State of Tasmania is well worth the attention of the British manufacturer and the British capitalist.

Discussion on the paper was deferred till the 12th May.

## Notes on a New Tasmanian Fish.

### By Mr. R. M. Johnston, F.S.S.

Mr. Rodway, who takes a keen interest in all branches of the natural history of Tasmania, besides that of his loved science of botany, of which he is now our chief local authority, has recently submitted for my examination a small fish, preserved in spirits. Unfortunately, there was only one specimen obtained, and it is so shrivelled up that some of the ray characters cannot be very exactly determined. This specially applies to the anterior portion of the dorsal rays, which for nearly half the length of this fin are rudimentary or undeveloped, and closely enveloped in a somewhat thick and (now) opaque skin. However, the principal dental, scale, and other characters leave no doubt in my mind as to its true generic position, viz., the genus Pseudochromis of the family Trachinidae. The following contains a fuller description:—Family Trachinidae. Genus Pseudochromis. Rupp. Head and body rather compressed, more or less elongate; cleft of the mouth slightly oblique, with the lower jaw longest; eye lateral. Scales of moderate size, ciliated; lateral line interrupted. One dorsal with a few spines anteriorly; ventrals thoracic; the lower pectoral rays branched; jaws with cardiform teeth, anterior with canines; vomer and palatine bones toothed. Praeoperculum entire. Six branchrostegals; the gill-membranes joined inferiorly; pseudobranchiae and air bladder present; pyloric appendages none. Indian Seas, Port Darwin, Macquarie Harbour, Tasmania. Pseudochromis rodwayi R. M. Johnston. D.3/26—27. A. 3/17. P. 17. L. lat. 50? L. tr. 11. The height of the body is nearly five times in the total length; the length of the head four and a half. In front of both jaws there are markedly curved canine teeth, the three in the lower jaw the stronger; there are, besides narrow bands of small canine teeth on jaws, vomer and palatine bones; no spines on the operculum. Dorsal and anal produced posteriorly; half of the anterior portion of the former undeveloped or rudimentary, and enveloped for the most part in a somewhat thick (now) opaque, skinny integument. The number of spines on dorsal probably three, but not determined satisfactorily. Diameter of the eye nearly equal to width of interorbital space, and greater than the length of the snout. Colour in spirits a uniform darkish brown. This interesting little fish is only about 3 6-8in. in length, and is somewhat of the general appearance of one of our common shore blennies. Mr. Rodway informs me that the fish was captured by Mr. Hinsby, an enthusiastic collector, in or near Macquarie Harbour. It is to be hoped that he may soon obtain a few more specimens, in order to settle a few doubtful points in some of the characters. It is remarkable that, with the exception of a single member of the genus (P muelleri), described by Klunzinger from Port Darwin), this is the first member of the genus caught in Australian waters. The specific name is given by me in honour of our own distinguished botanist, Mr. L. Rodway.

## Votes of Thanks.

The Hon. Adye Douglas (President of the Legislative Council) moved, and the Hon. N. E. Lewis (Premier) seconded, a vote of thanks to the president, which was cordially passed.

The President moved a vote of thanks to the readers of the three papers, which was also agreed to.

Members and the ladies present then adjourned to the large room, where refreshments were partaken of.

## ADDITIONS TO THE TASMA-
## MUSEUM AND ART GALLERY.

ig the Parliamentary session of
vote of £4,000 was passed for addi-
) the Tasmanian Museum and Art
, and it was decided to entrust the
ition of plans and specifications to
blic Works Department.

original design, prepared by the
. Hy. Hunter, in 1860, has been ad-
o externally, as far as practicable,
e interior has been altered con-
ly to bring it more up to date;
he original design was made iron
, steel joists, etc., were not avail-
nd columns were necessary to sup-
e upper floor. Now they have been
ed with, and the whole floor space
r in the new building.

ers for the work were invited in
ber, 1900, and Mr. W. H. Chever-
at £4,197 was the lowest, and was
d. The work was commenced in
y 1901, and the corner stone laid
Excellency the Administrator (Sir
Dodds), on the 20th March, 1901.

front portion, facing Macquarie-
is built of white and brown stone
Brighton and the Hobart Water-
quarries. In the upper part of
ont are three niches, which are
ed to be filled with statuary, etc.,
e future date. The side and back
re built of brick. The Museum
t Gallery floors are each 93ft. in
and 26ft. in width. A very or-
al embossed steel and zinc ceiling
n fixed in the Museum. The roof
e Art Gallery is open to the collar
and lined with pine boarding,
in light tints, suitable for pic-
llery. The roof is covered with
Welsh slate. It is lighted with eleven large skylights, all the glass being fixed in specially prepared lead grooves, and no putty whatever is used in the glazing, as is usually done, consequently there will be no fear of shrinkage and leakage. Ventilation has been amply provided, there being three large air pump ventilators fixed in the roof, which connect to large galvanised iron shafts, with ornamental zinc ventilating centres fixed in the ceiling. Fresh air is admitted through 18 large air shafts ,about 7ft. above the floor. Tasmanian blackwood guard rails upon turned blackwood newels are fixed round the gallery to protect the pictures from injury. An ornamental staircase of special design, made out of Tasmanian blackwood and Huon pine, gives the visitor easy access from the trophy room to the Art Gallery.

The open court between the old portion of Museum and new additions has been utilised and enclosed by brick walls, and the whole space (64ft. by 56ft.) covered with a very neat and light-looking iron roof, abundance of light being provided through a large lantern light in the centre and skylights round the sides over the windows of the old building. The roof is covered with galvanised corrugated iron, laid upon roofing felt, and the underside lined with colonial stringy bark boarding; the portion under the lantern, being varnished, has very much the appearance of English oak.

The whole of the work has been satisfactorily carried out by the contractors, Messrs. W. H. Cheverton and Son, and sub-contractors, under the personal supervision of Mr. J. Shield, Inspector of Public Buildings, and his assistant, Mr. J. Maddison, Clerk of Works, and the architect, Mr. Orlando Baker.

## MAY, 1902.

A meeting of the Royal Society of Tasmania was held on Monday evening, 12th May. His Excellency the President, Sir Arthur Havelock, G.C.S.I., G.C.M.G., who was to have presided, was prevented attending through indisposition. His Excellency sent a sympathetic letter, expressing his regret and interest in the business of the meeting. In his absence Mr. Thos. Stephens, M.A., senior vice-president, occupied the chair.

### The Late Sir James Agnew.

Mr. Stephens said that his unavoidable absence from Hobart at the time of the last meeting of the Society had prevented him from reporting his receipt in February last of a letter from the Royal Colonial Institute in reference to the death of the late Sir James Agnew. The secretary states that the Council "had received with great regret the announcement of the death of Sir James Agnew, for many years a valued and highly respected member of the Institute, and expressed their deep sense of the loss sustained by the Institute, as well as by the community amidst which he had lived so long, and by whom he was so universally and deservedly esteemed."

### Tasmania as a Manufacturing Centre.

Mr. G. E. Moore, C.E., opened the discussion on the paper read at the April meeting by Mr. R. E. Macnaghten on Tasmania as a manufacturing centre, especially in relation to water power. He said:—Mr. Macnaghten has drawn a very pleasing picture of Tasmania as a manufacturing centre, based upon its many natural advantages, especially with regard to its superior local conditions for obtaining cheap motive power derived from its lakes and rivers. What I propose to discuss is the reasonableness or otherwise of this foundation, on which he builds his hopes. His authority apparently is a report presented to Parliament by Mr. Rahbek, showing what power could be obtained from the water of the central lakes. Mr. Rahbek estimates that 57,000 h.p. could be delivered at Hobart from this source. A general statement of this kind is of no value to an engineer, and is distinctly misleading to the general public. With just as much accuracy I could state that there is daily 57,000 h.p. of wind power blowing to waste, or 57,000 h.p. steam power in undeveloped coal in Tasmania. To utilise to advantage this water power, two problems must be solved, engineering and commercial. The engineering problem resolves itself into the question whether the local circumstances are such as to enable the necessary works to be carried out to give a certain h.p. at a sufficiently low cost per h.p. to compete with steam. As regards the commercial problem, there is the necessity for constant remunerative employment of the power produced. Taking the engineering problem first, one of the chief necessary factors is a waterfall in proximity to civilisation. Unfortunately Tasmania does not possess a waterfall of any size, and to get a fall of even 10 or 15 feet per mile you must go 40 or 50 miles up the Derwent, and power derived from the central lakes would be double that distance away, so the elements for cheap construction are wanting. No doubt the power obtained would be turned into electric power, capable of being transmitted many miles, but although we hear of electric power being in special cases transmitted 100 miles and more, I think I am correct in saying that for practical purposes the economical limit is not over 20 miles at the present day. Then looking at the commercial side, Mr. Macnaghten mentions four indigenous industries: Woollen goods, beer, timber, and fruit as likely to benefit and increase owing to federation—as no doubt they will, but, unfortunately, they are not trades that require much power, so that if water power is to be largely used, it must be by introducing some new manufactures into the island. The position then is this. There is a large amount of water power undeveloped, but it is doubtful whether it would pay to utilise it at the present time. A practical solution of this question would be the erection of works to create and supply electric power. But Government would hardly be justified in engaging in such a speculation, and there does not appear to be sufficient inducement for any private company to enter the field. The question is entirely one of relative cost, and that you may more easily under-

it, I will endeavour to show the
imate capital cost per h.p. of
and water power. Steam plant
put down for, say, £30 per h.p.,
to put down a water power plant
ise the power of the Gentle Annie
he estimate is not less than £100
p. yet here we have a waterfall
high. To obtain a fall of 400ft.
y river, falling 40ft. per mile.
require a pipe or race 10 miles
ntailing a very large initial expen-
For this reason water can only
e with steam when the local con-
are exceptionally favourable,
s the proximity of a waterfall, or
capable of being produced on a
cale. This is the real reason why
ter power in this country is still
s popularly called running to
and it will continue to do so, un-
re is sufficient inducement for a
ry to sink from £50,000 to £100,-
a large power producing plant.
ly suggestion that I can make is
overnment should assist private
ise as far as possible by collecting
blishing useful information with
to rainfall and river gauging, etc.
night also advertise the fact that
re desirous of developing the lat-
ter power in the State, and with
tent are willing to deal liberally
ny person or company formed for
rpose. They will have to give
idea, which I believe they hold
is water power can be made a
source of income, and be content
e indirect profit to the State de-
from the establishment of new
ctures and new industries.

A. O. Greene said they were all
ndebted to Mr. Macnaghten for
rawing attention to the subject.
nceston, with the aid of the
running through the town a very
eal was being done by water
electric power for lighting, and
us other purposes was generated,
a great boon to the city in very
irections. He was much impress-
h the water power available in
te to aid in the development of
industries. It was not at all
ry in his opinion that there
first be one great and expensive
for developing the power. He
that it would do much good to
rected attention to this latent
hat was available in several dis-

Mr. R. M. Johnston, F.S.S., thought they must all agree that there was much water power available, but the question was whether it could be utilised with commercial advantage. It appeared that at present in transmitting electrical energy, generated by water power, over a considerable distance, there was a great deal of "leakage." There were engineers now in Tasmania alive to the existence of this water power in various parts of the island, and to some extent it was already being utilised.

Mr. Geo. Kerr looked forward to many manufactures arising in this State with the aid of water power. It would no doubt become a very valuable asset. The new Waverley woollen mills in the city were being worked by water power. He predicted that ere long paper mills would be established in Hobart.

Mr. Target, C.E., referred to the generation of electrical power on a large scale at Niagara Falls,

Mr. Macnaghten replied to the discussion. Mr. Rahbek's reports did not confirm Alderman Moore's view.

Mr. G. E. Moore could not find that Mr. Rahbek had gone into the financial aspect to prove that this water power would be remunerative, commercially.

Mr. Macnaghten: Last session of Parliament, two companies made application for rights to develop the water power. It was to be hoped that such a valuable asset of the State would not be given away. There was too much of the power of throwing cold water on projects existing in Tasmania. Tasmania would become a great manufacturing and industrial country if the people had more faith in their country, and more perseverance. (Applause.) He quoted Mr. Rahbek's report, which showed that 57,000 horse power (electrical) could be generated for use in Hobart, by utilising the available water power, and the place might become a great commercial centre.

Mr. Moore said it all depended on the cost of developing the power.

Mr. Macnaghten was accorded a vote of thanks.

## School of Forestry and Agriculture.

Mr. L. Rodway read a further paper by Mr. W. Heyn, who is connected with the Dover (England) harbour works, on the question of establishing a School of Forestry and Agriculture in Tasmania. The writer offered numerous detailed suggestions with respect to marketing numerous products, from apples to timber. The State could easily grow enormous quantities of those timbers which she was now importing, equal to one-third of her exports of timber, and paid two-thirds more for it.

Discussion on the paper was postponed till the next meeting.

## A New Fish.

Mr. R. M. Johnston tabled a description of a new species of Goby, which he named in honour of Mr. Geo. Hinsby, who has presented many specimens to the Museum, "Gobius hinsbyi." Mr. Johnston said :. There is no doubt that many more of the smaller types of our marine and fresh water fishes have as yet escaped the notice of ichthyologists, and our amateur sportsmen might do good service in preserving and forwarding to the Tasmanian Museum all forms of fishes which may seem to them to be new or in any way strange in appearance.

The meeting then terminated.

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List of books and magazines presented to the Royal Society of Tasmania during the month of May, 1902:—

Transactions of the Royal Dublin Society, Parts VIII. to XIII.

Proceedings of the Royal Dublin Society, Parts II. to IV.

Economic proceedings of the Royal Dublin Society, Vol. I., Part II.

Memoirs and proceedings of the Manchester Philosophical Society. Vol. 46. Parts III. and IV. 1901-2.

Atti della Reale Academia dei Lincei, Roma.

A list of the best books relating to Dutch East India, made up in commemoration of the third centenary of the foundation of the East India Co., March 20, 1602. By Martinius Nijhoff.

From Shanghai to Bhamo. By R. L. Jack, LL.D.

Proceedings of the Royal Society of England. Vol. LXIX. No. 457.

Boletim da Sociedade de Geographia de Lisbon.

Journal of the Society of Arts.

Journal of Agriculture of Victoria.

Proceedings of the Washington Academy of Sciences. (a) Papers from the Hopkins Standford Galapagos Expedition, 1898-9. (b) VII. Entomoiogica sults. Arachidna. By N. Banks. (c pers from the Harriman, Alaska Ex tion. XXVII. Apterygota, by J. Folson. (d) Organisation and Men ship of the Washington Academ Science.

The Scottish Geographical Magaz current numbers.

The Queensland Flora. Vols. I. t By F. M. Bailey, F.L.S., Governmen tanist of Queensland.

The Periodical. By H. Froude.

Litzury der Mathematisch Natu senschaftlichen.

The Victorian Naturalist. Vol. No. 1. May, 1902.

Annual report of the Colonial ratory of New Zealand.

Transactions of the Royal Irish demy. (a) Vol. XXXI. Part XII. ther developments of the Geome Theory of Six Screws; by Sir R Ball, F.R.S., LL.D. (b) Notes on High Crosses of Moone Drumcliff, monfechhin, and Killamery; by the Miss Margaret Stokes. (c) The An Forts of Ireland, being a contrib towards our knowledge of their t affinities, and structural features; T. J. Westropp, M.A. (d) Vol. XX The interpretation of a Quaternion, point of symbol. Part II. Quate Arrays; by C. J. Joly, M.A., Roya tronomer of Ireland.

Journal of the Royal Microscopic ciety of London. Part II. April, 1

Annals of the South African Mus Vols. II. and III.

Bulletin of the Natural History of New Brunswick.

The Royal Geographical Journal, don, April 1902.

Journal of the Scottish Meteorol Society (third series).

Statistics of the Colony of New land for the year 1901. Part III.— and Interchange.

North Queensland Ethnography. letin 4. March, 1902. "Games, S and Amusements." by Dr. W. E.

The Record of the Mines of South tralia, Tarcoola, and the North-We district, with plans by H. Y. L. B F.G.S., Government Geologist.

Report of the British Associatio the Advancement of Science held at gow, September, 1901. (Bound.)

Proceedings of the Linnaean Socie New South Wales. Part IV. XXVI. No. 104.

Monthly Notices of the Royal nomical Society. Vol. LXII. N March, 1902.

Boletim Mensal do Observatorio, ty of New Brunswick.

Boletin del Institutio de Geol Mexico.

## JUNE. 1902.

ıeeting of the Royal Society of
nia was held on the 10th June
Museum, Argyle-street. His Ex-
y the Governor, Sir A. E. Have-
ı.C.S.I., G.C.M.G., President of
ciety, presided.

### New Members.

J. H. Maiden, Director of the
c Gardens, Sydney, was elected a
onding member, and Messrs. W.
ılay and F. Grove were elected
rs.

### The Observatory.

A. Morton, the secretary, read
lowing communication from Mr.
Kingsmill, M.A., Government
ologist, Tasmania:—

vatory, Hobart, June 7, 1902. To
retary of the Royal Society. Dear
shall feel obliged if you will sub-
the consideration of the Council
lowing remarks on the meteoro-
service of Tasmania, having re-
to its present condition, and its
ts under federation. I am led
uest their attention for two
:—One, their readiness in the
give their help, on all occasions
t was needed for this work; and
er is that there is a crisis at pre-
ue to the advent of federation.
ising that changes must be made
ting Federal Premier has asked
States for detailed information as
cost and personnel of their Mete-
al Departments. The publica-
f this news in "The Mercury"
seem to indicate that the Govern-
f this State is leaving the way
receive suggestions. The Royal
is in a position to make sugges-
hat would, I believe, have great
with the Government. It will be
ered that a deputation from the
Society, in 1895, prevailed on the
ment to invite Mr. Wragge to
report on the meteorological ser-
Tasmania, and that he accepted
ıvitation. The report, coming
ne whose training and experience
eteorologist are so widely known,
o objects in view. One, to give
lony of Tasmania the benefit of
servations on the local meteoro-
arrangements, and suggestions for
ing the efficiency of the same. The
to at the same time benefit the
ology of the mainland by obtain-
ore thorough details from Tas-
which occupies a position of
importance to those engaged in forecasting. I therefore think that what has been so ably done, with the double object of ensuring local efficiency, and also federal benefit, in the matter of meteorological work, will be found the best guide on the present occasion in estimating the cost of the service now required. For Mr. Wragge's estimate, see General Remarks, page 15, paragraph 18, of his report. To those who know what the actual expenditure has been, it will be apparent that a mere answer to the Federal Premier of the question asked would not be a fair indication of the cost of an efficient meteorological service, as it would have to be worked under federal control. Moreover, it should be pointed out that Mr. Wragge's estimate is for meteorological work alone, and does not include the astronomical work of the department.

The character of this work, and the conditions under which it had to be done, are explained in a report furnished to Lord Gormanston in 1894 by Admiral Bowden Smith. This report was prepared by Captain Cust, of H.M.S. Dart, who had been specially trained in astronomical work at the Royal Observatory, Greenwich. His suggestions are most valuable. They are a complete summary of the conditions necessary for the maintenance of an accurate time-service in an important shipping port; but he makes no estimate of the cost. These two reports, by Mr. Wragge and Captain Cust, are herewith enclosed. They cover all the present work of the Meteorological Department of this State, and they furnish data on the highest authority obtainable for estimating the cost of enabling it to work in line with the other States. I hope that the Council of the Royal Society will see their way to make some representation to the Government, and I shall be in readiness to give them further information if it is required.—Yours, etc., H. C. Kingsmill.

"Meteorological observations in Tasmania were begun by Sir John Franklin in 1840. Being Governor of the island, then called Van Diemen's Land, he sent home for instruments, and when Captain Ross arrived at Hobart in August, 1840, in command of the Erebus, an observatory was built near Government House, and three magnetometers, a transit, clocks, and other instruments set up. Lieut. Kay, R.N., was put in charge of the Royal Observatory, which was called Rossbank, lat 42.52, 27.4 S.; long. 147, 27.30 E. Mean magnetic dip, 70deg. 40.5; variation, 10deg. 24.24 E. Here Lieut. Kay took hourly observations for eight years, Sir John himself helping in the magnetic observations. Mr. Francis Abbott, who had a private observatory in Murray-street, carried on observations tri-daily from 1841 to 1880. Being a member of the Royal Society, he supplied them with monthly meteorological reports, which are published in their yearly report. Observations were taken of barometer, temperature, humidity, clouds, and rain. In 1858, ozone was added. Observations were also started of rainfall, etc., by the Marine Board at the lighthouses under their care, and by gentlemen in different parts of the island, observations being taken in 1864 by Mr. J. Boyd at Port Arthur, Dr, Storey at Swansea, Mr. R. Henry at Tamar Heads. In 1865, by Mr. M. Duncanson at Ross, Mr. F. Belstead at Westbury, and Mr. W. E. Shoobridge at New Norfolk. Mr. Francis Abbott was obliged to relinquish his work in March, 1880, and in 1881 observations were taken only at New Norfolk by Mr. W. E. Shoobridge. In 1882, Captain Shortt was asked by the Royal Society to undertake the work. In March, 1883, a deputation from the Royal Society waited on the Premier, and asked him to establish a Government Observatory. This was done, and the present observatory in the Barracks started under Captain Shortt in 1883, lat 42, 53, 28.3, long. 147, 19.45 E. Captain Shortt remained in charge till his death in 1892."

Professor McAulay said he desired to impress upon the right quarter the very unsatisfactory state of the keeping of time in Tasmania, and the pressing practical importance of an improvement being made. Those who had to do with the keeping of time knew that it was a matter of life and death to some to know the correct time to the half second at least. Accurate time was of the highest importance to navigators, who, if they were a single second wrong in their time, might be out a quarter of a mile. It was a small thing to provide for the simple commercial matter of accurate time, but he did not think that the residents of Hobart at the present realised its importance. The observatory at Hobart had not a clock worthy of the name. The observatory depended upon a private citizen of Hobart, Mr. David Barclay, for reasonable time. There was an antiquated transit, and accuracy to the 100th part of a second could not be secured. The accepted way of announcing the exact time to the public was by the dropping of a ball, but it might be done at 9 o'clock at night by a single electric flash. Two or three instruments, two good clocks, a good transit, and a proper connection between the observatory and the ball would not cost more than £500, and an extra salary would, perhaps, be £50 or £100 more. It was unreasonable for the Federal Government to have taken over lighthouses if they did not provide for the keeping of accurate time in an isolated place like this as well as in other ports of call.

Mr. H. C. Kingsmill, Government Meteorologist, read some questions asked by the Acting Federal Premier in a circular addressed to the State Premiers on the subject of astronomical and meteorological establishments in the various States, and said that a bare answer to those questions would be exceedingly misleading to the Federal Government. Mr. Kingsmill then went on to say that the transit was certainly antiquated; and that when he took charge of the observatory he found the meridian mark out. He recommended that it should be changed, but the cost would be £3, and the money could not be got. (Laughter.) Yet, in spite of difficulties, the Admiral of the Australian station had acknowledged the accuracy of the time signals here. At Tamar Heads, the Melbourne Observatory had been connected with, and it was found that Victorian and Tasmanian time agreed "to the very tick" of the telegraph. This success had been obtained with an expenditure of labour, which would be altogether unnecessary if he had proper apparatus. Practically, the observatory standard time was Mr. David Barclay's clock, with which they had electric connection. As regarded meteorological work, they had ten stations, which sent in daily telegrams, and these were sent on to the mainland to enable the forecasts to be made. There was nothing mysterious about forecasts. They were simply the result of the combination of the barometer, the telegraph, and an army of observers, and were of great value to farmers and passengers by sea. There were 80 rainfall stations over the island, and these sent in monthly reports, and each year a map based upon them was made. Magnetic observations would be of great importance. An instrument in the Isle of Wight communicated knowledge of earth-tremors in any part of the world. That was one of the additional pieces of work that the observatory staff would be glad to undertake, if placed in a position to do so.

**Hon. N. J. Brown** spoke of the efforts of the late Sir Joseph Abbott and himself at the Federal Conventions at Adelaide, Sydney, and Melbourne to have astronomical and meteorological observations included in the subjects to be dealt with by the Federal Parliament, and of the great benefit these observations were to persons engaged in pastoral and agricultural pusuits. Accuracy and continuity throughout the Commonwealth were important. It was now probable that the whole of the Barrack "Reserve" at Hobart would be placed at the disposal of the inhabitants, and the observatory would have to be removed. But this need not be regretted, as the accuracy of the instruments was interfered with by the ironstone rock of the place. He moved,—"That the Council be requested to arrange for a deputation of its members to wait upon the Hon. the Premier for the purpose of urging that the reply to be sent to the Acting Premier of the Commonwealth to the queries as to the present staff, cost, and equipment of the meteorological establishment of Tasmania should be accompanied with a statement that the present arrangements for astronomical and meteorological observations are altogether inadequate, and that in the general interests of the Commonwealth it will be necessary in the future to provide for a fuller equipment, and a better paid staff, as suggested by Mr. Clement Wragge in his report to the Tasmanian Government, dated August, 1895, and by Commander Purey-Cust, dated April 5, 1894, and laid upon the table of the House of Assembly on July 10, 1894."

**Hon. A. Douglas** seconded the resolution, which was adopted.

### Tasmanian Conchology.

A paper by Mr. C. Hedley, F.L.S., entitled "Notes on Tasmanian Conchology" The author said : — "The study of Tasmanian conchology has been facilitated by an excellent catalogue published last year by the late Professor Tate and Mr. W. L. May in the proceedings of the Linnean Society of New South Wales. Therein certain species ascribed to Tasmania by the Rev. J. E. Tenison Woods were rejected from the fauna chiefly because no later observer had taken them. Though apparently of foreign origin, their exclusion could not be wholly justified until that origin was ascertained. At the invitation of Messrs. A. Morton and W. L. May I undertook their examination. From the result it appears that five West Indian species were supplied to Tenison Woods, which he erroneously described as Tasmanian, and as new to science."

On the "Advantages of Forest Conservation," by Mr. C. B. Target: —

**Mr. C. B. Target** read the following paper," On the advantages of Forest Conservation" : —

First, as to the term forest. In England a forest is a place reserved for wild beasts of the chase, and is not necessarily covered with timber. In Scotland many of the deer forests have few trees. On the contrary, on the Continent of Europe, a forest is an agglomeration of timber trees divided into two main classes—pure and mixed. The former is when the forest consists of only one species of timber; the latter when there are several kinds growing together.

It is in the Continental sense that the term is used in this paper; also, it relates more to sylviculture ,which refers to woods and forests, rather than to arboriculture, which deals only with woods and plantations. In the one the tree is the unit, and the wood is considered a collection of trees; in the other the wood is the unit, and the trees are considered only as its constituent parts.

In Britain shelter is the primary object of the woods; on the Continent of Europe the material, or pecuniary, product is of primary importance.

In an address by Dr. Tholard, he says:— When the mountains arose in the geological revolutions which gave them birth, they must have presented themselves in the condition of bare rocks or banks of solidified matter, without trace of vegetation. They first crumbled by the action of water; this was followed by a chemical action, due to carbonic acid, which, combining with the alkaline elements of the rocks, decomposed and dissolved them; thus was produced a layer of soil capable of sustaining vegetation; then the first forms of vegetable life ,of which the seeds were air-borne, their roots working downwards and assisting to crumble the rock, and by their decomposition, when they died, improving the soil, till at last large trees could be supported, the seeds of which do not germinate, except on soil which has been previously occupied and prepared for them by other vegetables.

Amongst other things, it has been noticed by Marsh that whenever a tract of country, once inhabited and cultivated by man, is abandoned by him and domestic animals, and surrendered to the undisturbed influences of spontaneous nature, its soil, sooner or later, clothes itself with herbaceous and arborescent plants, and, at no long interval with forest growth for this three negative qualities, exemption from defect or excess of moisture, from perpetual frost, and from the depredations of men and browsing quadrupeds.

We thus see how the forest grew, and by continually shedding its leaves increased the depth of vegetable soil, till man made the forest give place to the garden and to the fruitful field, produced by man's device. We might thus assume that the sole use of the forest is to produce the soil for agriculture. But all is not gain. Evil as well as good has followed in the wake of the artificial change. Marsh says as follows:—With the extirpation of the forest all is changed. At one season the earth parts with its warmth, by radiation to an open sky; receives, at another, immoderate heat from the unobstructed rays of the sun. Hence the climate becomes excessive, and the soil is alternately parched by the fervours of summer, and scarred by the rigors of winter. Bleak winds sweep unresisted over its surface, drift away the snow that sheltered it from the frost, and dry up its scanty moisture. The precipitation becomes as irregular as the temperature; the melted snows and varied rains, no longer absorbed by a loose and bibular vegetable mould, rush over the frozen surface, and pour down the valley seawards, instead of filling a retentive bed of absorbed earth, and storing up a supply of moisture to feed perennial springs. From the soil being no longer protected, the action of the sun and wind dries up the surface, and forms dust which is washed into the streams, and tends to silt up the rivers forming bars at their mouths, and spoiling harbours made by nature. This state of affairs has been going on since long before the advent of Christianity, and numerous cures have been suggested, till scientific forestry has stepped in to remedy the evil, although vast tracts of forest have been destroyed by natural causes, such as frosts, drought, epiphetic and parasitic vegetable growths, and insects, birds, and beasts.

But to a far greater extent have forests been destroyed by reckless fellings in wasteful exploitations; to some extent have injuries been done by flocks and herds depastured in the woods; and to a great extent have forests been destroyed by fire applied to the clearing away of trees, in order that the ground may be obtained for agriculture, and by fires attributed to accident, but to accident attributable to the carelessness of man.

There must be conservation against destruction occurring irrespective of man's agency, against destruction through man's carelessness, against destruction through man's dishonesty, and with this an improved, more economic, and less wasteful forest exploitation; with which, again, may be conjoined forest restoration, reboisement as a preventive of the formation of destructive torrents and inundations, or to assist rainfall, or arrest and utilise drifting sand.

The climate of countries covered by forests is more equable than that of deforested countries. This benefit derived from forests has been proved in France, Germany, the Cape, and India by simultaneous records inside and outside forests. Where the land is densely wooded the rains may be diffused more or less equably over several months in the year, and may frequently be of a drizzling character, while in a land similarly situated, devoid of trees, rain falls irregularly in what seems like thunder plumps, and in extreme cases whole years may pass without rain, as is the case in the Karoo, South Africa, and Aden, South Arabia; and the rain in the forest land may fall pretty equably over the whole district, while in the land devoid of forests it falls now here, now there; falls, it may be, in torrents, deluging the land, while extensive districts are left dry—both occasioning great inequality in the distribution, even where the quantity of rain falling may be proximately equal; and the inequality in benefit from what falls is made still greater by the torrential occasional rains draining off rapidly to the river beds, and by them to the sea, while the woodlands absorb and retain a much larger portion of what falls on them. And thus is fulfilled what is written: "The earth which drinketh in the rain that cometh oft upon it bringeth forth herbs, meat for those by whom it is dressed, and receiveth the blessing of God; but that which beareth thorns and briars is rejected, and is nigh unto cursing."

The following, by Jules Maistre, would refer to the vine industry in Australia:—"The phylloxera has its propagation facilitated, or has the way prepared for it by the most powerful and most general enemy of this entire region. It is manifest that this is the enemy, which equally with that, or still more, should command our attention and our vigilant watchfulness, and that against which we ought to contend with our greatest energy."

With us it is the enemy not only of the vine, but of all culture: this enemy which successively and progressively has made the peasant to give up the culture of flax, of hemp, of maize, and of grain; this enemy which has constrained us to substitute for the culture of cereals, which had become almost unproductive, that of the vine, an arborescent culture with deeper roots. This enemy which is increasing every day with greater damage than that caused by the phylloxera is drought.

In Coorg and the Wynaad, and also the Shimoger district of Mysore, India, it was found that the borer was worse where the bamboo had been cut, so the planters have largely replanted the bamboo, with the result of keeping down the borer, which has helped destroy the coffee industry of Ceylon.

May not the entomologist find that the Californian scale on fruit trees is owing to its natural habitat being destroyed; for surely this pest was in the world before it began to damage apple trees?

Truly man cannot interfere with Nature without suffering sooner or later for his presumption. He may damage, but he has not learnt to improve. Nature will yield a portion of the surface for cereals, but when that area is encroached on too much, drought and floods destroy what man has done, but does not always, or rather seldom, restore the damage done by man.

Now, amongst the advantages derived from forests are the following industries:—Sawmill, buildings, shipbuilding, engineering, farming, carving, paper pulp manufacture, match making, manufacture of cases, boxes for fruit, etc., frames of sieves and drains and cask hoops, wooden wire for table covers, and blinds, pencils, wooden nails, instruments, shovels, spoons, shoes, lasts, saddle trees, staves for barrels, brushes, harrows, gunstocks, furniture, toys, timber for mines, railway sleepers, etc. In Germany these industries support 3,000,000 people, but owing to the greater frugality of the Germans, the longer hours of labour, and lower wages, no competition could be started against the import of the manufactured article. In wood pulp there is an exception. In a letter from Mr. Henri Ami, of the Dominion Geological Department, he states:—"There is no doubt a big future for Canada in the direction you mention; in fact, the world is looking towards Canada's coniferous forests for its supply of paper for the coming generation, and if Canada will only extensively and vigorously carry out a prudent, provident policy in connection with this industry, as well as lumbering, there is no doubt that we can control the output in years to come. British Columbia has, as you know, fine coniferous forests. May they be everlasting, and they can be so by careful attention, and judiciously enforced legislation." With reference to inquiries as to forestry in the United States, it shows that there was little systematic work carried on, except in New York State, and the main conclusion arrived at was, "There were but poor depauperated forests left in the United States just south of us."

Again, from the "Journal of Commerce of New York."—"But the main ground of objection to the privilege Congress has given to the paper manufacturers—the letters of marque and reprisal which Congress has given to the paper trust to prey upon the book and newspaper trade of the country—being frankly stated, a second reason of a very substantial character, is that, although pulp woods are free of duty, for the profit of the paper trust, the duties on pulp and paper stimulate the ruinous consumption of American forests. When forests are cut for timber, the smaller trees are spared, but the pulp men cut everything down to six inches at the stump, so that the spruce forests, ravaged by the paper makers, are not perpetuating themselves."

The National Irrigation Congress, a year and a half ago, and the National Forestry Association, have urged that all public lands, more valuable for timber than for cultivation, should be absolutely withdrawn from sale by the general government.

The efforts now making on a wide scale to preserve the forests do not spring from altruistic regards for the well being of the next generation. So far as the future supply of timber is concerned, the destruction of our forests will only make timber more expensive, and lead to a freer use of metal for the purposes of construction. It is the farmers' need of rain, and the cities' need of drinking water that is inspiring the efforts, legal and scientific, State and National, to retard the destruction of our forests. In England, New York, and the older part of the West, the denudation of the soil has already proceeded, so far as to seriously diminish the volume of the rivers. This has unfavourably affected the water supply of some of our cities, and it is diminishing the evaporation upon which agriculture must depend for its rainfall. It is for the sake of the crops, and for the sake of the water supply of towns that efforts are now making to check the reckless destruction of the forests. The enormous profit the pulp paper men are making evinced by the capitalisation of the Trust at £11,000,000 sterling, and absorption of mills at a valuation of £5,500 pe ton of daily output, which mills, wit entirely new machinery, can be erecte at 30—40 per cent. of that, offer an immense premium upon the rapid destruction of the forests.

Forests and Reservoirs.—From American "Gardening," October, 1901.—F. H Newell, Hydrographer, United State Geological Survey, makes a few remark which should appeal to all who cultiva the soil. He points out that the full development of the United States, especially of the arid West, rests upon a complete utilisation of the water for irrigation, power, and municipal, as well as domestic supply. Furthermore, as the evaporation of the water, and protection from pollution, both natural and artificial, rests largely upon the proper treatment of the forests at the head-waters of the streams, there can be no question as to the beneficial influence of these forests, although the extent of the influence may be, and still is, open to investigation and discussion. The forests, with the accumulation of vegetation upon the ground, serve to break the force of the rain, and regulate the run-off, excessive soil erosion is to a large extent prevented, and the waters drained from a forest are, as a rule, free from suspended mineral matter.

The Government has set about the protection of forests upon the head-water streams of the West, and Congress has under consideration legislation tending to promote the construction of large reservoirs within or adjunct to the forest reserves. Here are to be found at the head-waters of the streams many valleys whose outlets can be closed by a dam of moderate height, holding back the water from melting snow, or from occasional storms. These natural reservoir sites are being surveyed, and their capacity and cost ascertained. The amount of water available for storage is also being measured, and the facts recorded so as to make it possible to know definitely the benefits to be derived from the construction of these hydraulic works.

One of the sources of anxiety and uncertainty in regard to these reservoirs is the matter of silt and sediment.

The flood waters roll along sand, gravel, and even boulders, depositing them wherever the current is checked. These floods, entering the artificial reservoirs, are brought to a halt, and quickly lay down their load, forming a coating or layer of mud in the reservoir, tending to greatly diminish the storage capacity. If the waters come from forested slopes, where the soil is protected and held by roots, the amount of settlement may be negligible; but if, on the other hand, these forests are cut away, the underwood humus burned, the driving storms soon attack and move the loose earth and disintegrated rock, starting it on its journey down the slopes, to be finally caught in the reservoir below. Thus it happens that it is of the first importance for the prolonged life of the reservoir that every care should be taken to perpetuate the forest cover upon the catchment area, wherever this can assist in holding the soil.

It may be here mentioned, wl
afforestation is out of the questio
when the volume of water in the
entering the reservoir is so great
portion to the size of the reservo
the inertia of the water in the res
is insufficient to arrest the velocity
stream entering, the remedy is ei
make the reservoir larger, or to
greater number of reservoirs furt
the valley before the minor strean
formed one large stream beyond
as to power.

Monsieur Valle, in a work e
"Etudes sur les inondations," gi
table of floods in the Seine fron
showing that the height of the
has decreased from 8.39 metres
metres, and makes this deductior
that the felling of forests gives u

More rain annually.

Less flood water.

More cultivated land.

But he omits to mention that the
Edict of Colbert, made in 1669, w
ing to the denudation of fores
France, and that the since then
have increased, especially the Com
Forests, in the beginning of
century, and the end of the
under Napoleon, when, for
years, all private felling, w
permission was strictly proh

Schlich states that—

The climate of forested countries i
equable than that of deforested cou

The mean temperature is lessene

The reduction of temperature n
hurtful where crops do not ripen in
but very beneficial elsewhere.

As forests moderate extremes o
perature, plants grown under their s
do not suffer so much from the effe
early frosts or drought as plants gr
in the open.

There is an excess of from 3 to
cent. of moisture in a forest.

After allowing for the water inter
by branches, etc., running down
trunk, 12 per cent. may be allow
stopped by the forest. Against th
evaporation in a forest, where th
leaf mould, is only 22 per cent. of tl
the open, and this more than compe
for the loss of rain reaching the gr

As to the effect of forests on slo
will give the case of Hoshiapur, i
Punjab, where formerly the hills
covered with forests, but by the a
man, and the grazing of cattle,
forests have disappeared. The tre
of sheep and goats has loosened the
The soil being no longer bound tog
by roots, ravines have been formed
debris actually destroying a part c
town. This is what may possibly
pen to any irrigation works started

e advantages of sylviculture are:—

To yield the timber necessary for in purposes.

To produce the greatest quantity per per year.

Co produce the highest possible money n per acre per year.

To produce the highest possible interm the invested capital.

To influence the climate, to regulate draining of the country, and prevent slips and avalanches.

e following table gives the results of it culture in several different counas far as possible. Only the Crown its are given, as the results of private stry are not obtainable, so the areas n are very much less than those of the l areas under forest:—

| Country. | Area in acres. | Expenditure. | Revenue. | Profits. |
|---|---|---|---|---|
| | | £ | £ | £ |
| Baden ... ... ... ... ... | 1,120,000 | 510,000 | 1,270,000 | 760,000 |
| Bavaria... ... ... ... ... | 2,500,000 | 1,230,000 | 1,800,000 | 570,000 |
| Prussia ... ... ... ... ... | 6,000,000 | 1,050,000 | 2,100,000 | 1,050,000 |
| Austria ... ... ... ... ... | 2,330,000 | 3,103,000 | 3,193,000 | 90,000 |
| France ... ... ... ... ... | 2,110,000 | 533,029 | 1,540,000 | 1,006,971 |
| The expenditure in France includes roads and plantations. | | | | |
| Sweden ... ... ... ... ... | 4,000,000 | 35,789 | 56,807 | 21,018 |
| Forest maintenance in Sweden is only recently started. | | | | |

India.

| Year. | Area in acres. | £ | £ | £ |
|---|---|---|---|---|
| 95-96 ... ... ... ... ... | 9,657,000 | 911,161 | 1,660,504 | 749,313 |
| 96-97 ... ... ... ... ... | — | 933,955 | 1,733,869 | 799,911 |
| 97-98 ... ... ... ... ... | — | 667,617 | 1,159,676 | 492,059 |
| 98-99 ... ... ... ... ... | — | 660,478 | 1,239,912 | 569,434 |
| 99-00 ... ... ... ... ... | — | 730,175 | 1,235,425 | 505,250 |

£ in the case of India has been , as in the official returns, as Rs. r purposes of comparison. The from the forests in 1869 was £139,971. Since then, although a large portion of the revenue has been spent on reafforestation, yet the revenue has largely increased.

In European countries, which have been chosen as their climate more nearly approaches that of Tasmania, the total acreage of Crown forests is 18,060,000 acres, with a net profit of £3,376,971, or 3s. 10½d. per acre. This net profit, capitalised at 5 per cent. would give £3 17s. 6d. as the average value of each acre, and this is including large areas, of which some are inaccessible, and some valueless for tree planting.

During the last 10 years the country lots of Crown lands sold in Tasmania amounted to 248,924 acres, at an average price of £1 7s. 4¾d.; this, at 5 per cent., would give 1s. 4½d. per acre, so that, even after allowing for the hours of labour being less, and wages being higher than in Europe, twice the amount of the revenue yielded by the investment of the money obtained by the sale would be obtained by a judicious system of forestry on the same land. All the best land is first selected for agricultural purposes, so the price of sale and the small return given for perpetuity is presumably for the best land, whilst the returns for European forests are for all the land, including bad, and in many areas thoroughly denuded of trees, this is especially the case with the Crown forests of Sweden.

According to information kindly given me by Mr. Counsel, the area of the button grass land, which is absolutely worthless for agricultural purposes, is not less than 1,150,000 acres, and as it has been shown that forests are necessary for the climate, which is said to have become colder during the last half century, whether due to the denudation of forests or not, may be questioned by some, but the excess of evidence shows that forests cause milder winters, whilst the intense heat of summer is moderated; for agriculture, grazing, etc., it is necessary to strip a large area of land of its covering of trees, but at the same time they may be replaced elsewhere.

On the basis of a net return of 2s. an acre, and a gross return the same as in Europe, a rise of 26 per cent. may be given for the wages, but as the age at which trees mature in Tasmania is said to be half that required in Europe (see "A Practical Treatise on Tree Culture in South Australia," by J. E. Brown, L.L.S.), the profit may safely be taken as double. The exact profit caused by quicker growth must be more or less left for experience, although the age of timber may be judged by the rings.

Taking the time required for the pine tree to mature in Europe to be 112 years, every £100 of initial cost of planting at

2½ per cent. per annum compound interest would amount to £1,600, whilst if the trees matured in 84 years the compound interest would be £800; but if Mr. Brown's figures be adopted, only £400 would have to be deducted from the sale of the timber planted at a first cost of £100. No allowance has been made for maintenance, as this is met from the sale of the thinnings. In England, where the cost of labour more nearly approaches the rates prevailing in Tasmania, Dr. Schlich, a forest authority, states that allowing 100 years for the growth of the pine and 2½ per cent. compound interest for the money laid out, the result is £185, equivalent to 7s. 6d. per acre per annum after all expenses are paid, so surely with the quicker growth in Tasmania the estimate of 2s. per acre is a very safe one, presuming the trees are allowed to come to maturity. But I would not suggest this, but rather that the button grass land be planted with spruce, Scotch fir, and, as suggested by Mr. Rodway, stringy bark, and that a twenty year rotation be adopted for the stringy bark, as the tree after this would not be suitable for pulp. Allowing only stringy bark to be grown, and assuming that the growth is only that of the spruce, it would take 71,400 acres to supply the American consumption of wood for the pulp industry, estimated at 90,000 tons yearly. Allowing the spruce to weigh when green 40lb. per cube foot, this would give 5,000,000, and the German yield of spruce, 20 years old, is given as 1,400ft. per acre.

For spruce and Scotch fir a rotation of 60 years might be adopted. This would give the yield per acre as 5,400ft., 57,800 acres to supply this requirement annually, and would enable a most profitable industry to be established; an industry that pays so well that the American Paper Trust can afford to give 30—40 per cent. more for an old mill than it would cost to erect a new one with up-to-date appliances.

It is very probable that the button grass land might require some open drains before it be planted, but the advantage would be that we should be exporters instead of importers of deal and pine woods, and also that the oak could be grown as well as the pine by having the tap roots cut when planted, it having been shown by Duhamel that this does not interfere with the growth of the tree, but on the contrary, when the subsoil is sour, the growth is hastened. This has been largely adopted with great success on the Landes in France.

On the sandy wastes on the North-West Coast of Tasmania the Pinus pinaster might be planted with advantage. This would arrest the sand, and large areas of ground recovered for cultivation, leaving belts of pine to prevent the sand again moving, and after the pinaster has run its course, the Scotch fir might be planted, as the soil would then be in a fit state to grow it.

One of the principal products of the Pinus pinaster is resin and turpentine, after which the wood is used for charcoal or firewood. It might, very possibly, having lost its resin, be also good for pulp.

The oak, as well as the pine, would serve to increase the exports, and in compartively few years stop the imports, and cause a large export trade. For, owing to the ruthless manner in which the forests in America are being denuded of timber, the price is almost certain to rise, thus increasing the profit on all timber trees that are now planted.

The oak will find a ready sale for staves for barrels, which are now imported into Australia for the wine industry, and it is to be hoped that the cider industry will soon increase under federation in Tasmania.

One of the principal difficulties in extending the timber trade of Tasmania is decidedly the uncertain quality of the timber. This would, in a great measure, be overcome by the introduction of a Forest Department, for then, instead of the present license system, the trees that would have to be cut would be marked, and sold by auction. The approximate quantity required being estimated by the department, by this means, the trees would be ringed at the proper time. I am informed that the period for the rise and fall of the sap varies with the ages of the tree. Facilities would be given for carting the timber, or else it would be felled by the department, and the tress taken to a depot, and then sold. This latter system is in force in many parts of India.

For maintenance the usual average is 5 days work per acre, or from 40—60 acres per man. This, on an estimate of 600,000 acres, being carefully looked after, would require 10,000 men; thus an extra population of 30,000 people would be supported, exclusive of saw-mills; whilst making, preparation of turpentine, etc., would support some thousands more.

The total yield of an acre of spruce, 60 years old, after adding the amount given by the thinnings, may be taken at 8,250ft., so that after allowing 25s. a year for labour, any price over 2½d. per cubic foot would be profit (5d. per foot is allowed in England). No allowance has been made for the rapid growth of spruce in these colonies, as it has been left for a margin of safety, as these are only approximate figures taken from the yield given in German forests.

There is one matter to which I must draw attention, that is the scale of charges levied to give animals a free right to destroy young trees, which varies from 1s. 6d. for a horse, to 3d. for a goat, one of the most destructive, if not the most destructive animal that can be turned into a forest, except, perhaps, a camel.

The great necessity for a Forest Department is to see that the young trees which make the forest of the future are cared for. Without this a forest is either destroyed by being cut down, or, in due course, it perishes naturally, and disappears of itself. In either case the result is deeply to be deplored, for when once a forest disappears it can only be replaced at a great expense of time and money.

As a proof of what has already been effected in India by forest officers educated in European schools, I may mention that in 1884 there were in that country 9,820,000 acres of reserved forests, the whole of which are managed on the principles taught in the European Schools of Forestry, and 2,493,000 which are protected from fire, as well as cattle and sheep grazing, and goats, and consequently are now in a condition to reproduce themselves, under the natural system, and as perhaps the most convincing proof, from a financial point of view of the value of the system, the forest revenue, which in 1870 was £357,000, of which £52,000 was profit, in 1880 reached £545,000 with a net profit of £215 000; and in 1900 the gross revenue was £1,235,425, with a net profit of £505,250. These figures speak so very eloquently that no comment is needed.

A Forest Act was passed in South Australia in 1878, and in 1883 a quarter of a million trees were planted out, and the forest revenue amounted to £6,517, against an expenditure of £6,200. Last year the revenue was £14,421; the expenditure, as far as can be seen from the Blue book, £12,675.

Why cannot we also secure the preservation of our forests, and plant, when forests are destroyed for the purpose of of agriculture, to restore, or rather maintain, what Nature has done to render the Tasmanian climate one of the most perfect in the world.

## Adjourned Discussion.

**A proposed discussion on Mr. Heyn's paper was postponed till next meeting.**

## Vote of Thanks.

**On the motion of His Excellency, a** vote of thanks was passed to those who had read papers.

The proceedings then terminated.

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List of works presented to the Royal Society's Library during the month of June:—

Atti della Reale Academia dei Science, Roma, current numbers, from the Society.

Records of the Australian Museum, vol. VI., No. 6. From the Trustees.

Journal of the Linnean Society, London, vol. XXVIII., Zoology, No. 184, XXXV., Botany, No. 244. From the Society.

Proceedings of the Geographical Society of Australasia, 1st session, 1885-6, vol. I.

From the Society. Notes sur les Fourmis et les Guepes Extracts des Comptes rendus des Seances de l'Academie des Sciences. Rapports des Animaux. Myrmecophiles avec les Fourmis, 1897. Liste des Travaux Scientifiques. Les habitations a Bon Marche dans Villes les de Moyenne Importance. Sur l'Emploi de Desinences. Caracteristiques dans les Denominations. des groupes etablis pour les Classifications. Recherches sur L'Anatomie de la Fourmi et essai sur la Constitution. Morpholcgique L'Esthetaque dans les Sciences. De la Nature. From the Academie, Paris.

Contribution to Canadian Palæontology, vol. II., part 2, "Canadian Fossil Insects," by S. H. Scudder. Additions to the Coleopterous fauna of the Interglacial clays of the Toronto district. With an appendix, by A. D. Hopkins, on the Scolytid borings from the same deposit, vol. IV., part 2. A revision of the genera and species of Canadian Palæozoic Corals, the Madreporaria aporosa and M. rugosa, by L. M. Lambe, F.G.S. Catalogue of the Marine Invertebrata of Eastern Canada, by J. F. Whiteaves, LL.D., F.G.S. From the Geological Survey of Canada.

Journal of the Agricultural Department of Victoria, vol. I., part 6, 1902. From the department.

A Trencsen Varmegyei Termeszettud Qmanyi Egylet, 1900-1. From the Society.

The Quarterly Journal of the Geological Society, vol. LVIII., May 15, 1902, No. 230. From the Society.

The "Emu," vol. II., No. 1. From the Society, Melbourne.

The Indicator on Gold Mining, No. 3,

the Creswick Field and its Mining, by W. Bradford. From the editor, Ballarat.

Bulletin of the Museum of Comparative Zoology at Harvard College, vol. XXXIX., No. 2; "Chiriqui Mammalia," by Outram Bangs, vol. XL., No. 1; Changes accompanying the migration of the eye, and observations on the Tractus opticus and Sectum opticum in Pseudopleuronectes americanus, by S. R. Williams. From the Society, Mass.

The Gums, Resins, and other vegetable exudations of Australia; Useful Australian Plants; Notes on Eucalyptus trees, from the point of view of the Bee-keeper; Some Australian Vegetable Fibres; The Cork Oak (Quercus suber), a useful tree for New South Wales; Records of the Sydney Botanic Gardens, by J. H. Maiden, Director of the Botanic Gardens, Sydney. From the author.

A list of plants collected in the vicinity of the Jenolan Caves, by W. F. Blakely and J. C. Wiburd. From the Director of the Sydney Gardens.

Memoirs and Proceedings of the Manchester Literary and Philosophical Society, vol. 46, part 5, 1901-2. From the Society.

The Geographical Journal, May, 1902, vol. XIX., No. 5. From the Society, London.

Catalogue of New and Recent Books, April list. From Henry Froude, London.

The Scottish Geographical Magazine, vol. XVIII., No. 5, May, 1902. From the Society, Edinburgh.

Journal of the Society of Arts, May, 1902. From the Society.

The Year Book of the Royal Society, London. From the Society.

The Ibis, April, 1902.

The Victorian Naturalist, vol. XIX., No. 2, June. From the Society.

Proceedings of the Royal Society of Queensland. vol. II., parts 1 and 2, vol. III., vol. V., parts 3 and 4, vol. VIII., parts 2, 3, and 4, vol. XI., vol. XVI. From the Society.

Proceedings of the Royal Society, London, vol. LXX., No. 459, May 12, 1902. From the Society.

Monthly Notices of the Royal Astronomical Society, vol. LXII., No. 6, April, 1902. From the Society.

## HOBART OBSERVATORY AND ITS WORK.

### DEPUTATION TO THE PREMIER.

A large deputation, representing the Royal Society of Tasmania and other public bodies at Hobart, waited upon the Premier, the Hon. N. E. Lewis, C.M.G., on Tuesday, June 17, 1902, with respect to the work of the Hobart Observatory.

The Hon. Nicholas Brown said it was known that the Federal Government had been in communication with the Premier of Tasmania on the subject of the Observatory at Hobart, and it was thought that, in reply, to furnish mere facts would be somewhat misleading. Neither the staff nor the equipment of the Observatory was satisfactory. There was in existence a report upon the subject from Mr. C. Wragge, of Queensland, who visited Tasmania some years ago, which stated what was wanting. Mr. Wragge stated that £600 would be sufficient to provide the necessary staff and properly equip the Observatory for its work. At a meeting of the Royal Society, held on the 10th, the following resolution was adopted:—"That the Council be requested to arrange for a deputation of its members to wait upon the Hon. the Premier for the purpose of urging that the reply to be sent to the Acting Premier of the Commonwealth to the queries as to the present staff, cost, and equipment of the meteorological establishment of Tasmania should be accompanied with a statement that the present arrangements for astronomical and meteorological observations are altogether inadequate, and that in the general interests of the Commonwealth, it will be necessary in the future to provide for a fuller equipment, and a better paid staff, as suggested by Mr. Clement Wragge in his report to the Tasmanian Government, dated August, 1895, and by Commander Purey-Cust, in his report, dated April 5, 1894, and laid upon the table of the House of Assembly on July 10,1894." He handed copies of these two reports to the Premier, and urged, on behalf of the Royal Society, that the Acting Premier of the Federal Government may be fully informed as to what would be required to be done both as to astronomical and meteorological equipment before the Tasmanian Observatory can do its work effectively as part of a general national organisation.

Mr. A. Morton read the following letters, which had been received on the subject of the deputation:—

"Bushy Park, June 14, 1902. Mr. A. Morton. Dear Sir,—As I am afraid I cannot be at the deputation on Tuesday, I am sending a record of Mr. Wragge's disturbances. I have had to rule the paper, and the readings of barometer are marked twice a day, and connected by pencil mark, showing curves of depressions. The names of disturbances are written down as soon as advertised, and, as I estimate their speed a 300 to 400 miles a day, they are often entered five to seven days in advance, and form a very reliable forecast of the weather. They always come as foretold, but sometimes go north or south of Tasmania. It depends on what part of the depression passes over here whether we get more wind or rain, and this can be known by the steepness of the waves. You will notice by the records that a wave is mostly followed by a smaller or half-wave, and it is during this small wave that most of the rain falls. By carefully watching the progress of the waves, in conjunction with the forecasts, a fairly reliable estimate of coming weather can be made for three or four and sometimes six or seven days, in advance. I need not say how important this is for all farming operations, and in scores of instances we have planned our work in reliance on these records, and have very seldom been disappointed. The most disturbing element is easterly or south-easterly weather. The rain from that quarter mostly coming with a high barometer. The black marks at bottom lines indicate the rainfall, each line being the tenth of an inch. If these sheets could be provided, anyone with a barometer and rain gauge could record the readings and rainfall, and, in conjunction with Mr. Wragge's forecasts, could form a fairly reliable estimate of coming weather. Much more might be done by giving more detailed information as to the course and velocity of the disturbances. I can only hope that, instead of lessening the information given, it will be increased, to the great benefit of agriculturists.—Yours, etc., W. E. Shoobridge.

"Launceston Hotel, June 16, 1902. Dear Morton,—I am sorry that I shall not be at the deputation to-morrow re the meteorological service. I am heartily in accord with the objects in view; not only as absolute necessity from a national point of view, but as a matter of great interest and use to the general public. A great nation should not exist without a great meteorological service.—Yours, etc., W. V. Legge."

Professor McAulay, M.A. (Tasmania University) spoke strongly of the necessity of keeping accurate time in Hobart, so that mariners would be able to regulate their chronometers. Hobart was at the present day an important shipping port, and promises soon to be still more important; also it is a port of call for large ships two days out from a port (Sydney) where they have accurate time indicated. These ships subsequently have a voyage of many days before again reaching a port where time is accurately kept. Chronometer rates are different when at sea from what they are on board. Navigators require in Hobart to have Greenwich time to be given to them just as accurately as it can be obtained. Thus a tenth of second error in Hobart may mean several seconds error at a time when a large ship is reaching a dangerous coast, and this may mean all the difference between safety and danger. The matter is, therefore, clearly one of Federal interest. The equipment in Tasmania for keeping time is altogether inadequate to fulfil the requirements above indicated. There is not even (1) a modern transit instrument, nor (2) a reliable clock. Two citizens are practically supplying (the one by electric connection with the Observatory, and the other by the loan of a ship's chronometer) the deficiency in the matter of clocks. Also for utilising the proper equipment for obtaining time accurately it is essential that, at least, one observer should be paid, whose first duty should be to thus make time observations. The State Government ought to provide for two matters recommended by Commander Purey-Cust, R.N., in the paper referred to by the Hon. N. J. Brown. The one is to make permanent, by a suitable inscription, the standard of longitude, left us by the American astronomers, who observed the transit of Venus. The second is to provide for the Observatory a permanent meridian mark.

Mr. H. C. Kingsmill, M.A., Meteorological Observer, said that the Royal Society of Tasmania had brought into notice two forgotten reports, one of which dealt with the meteorological work of the Observatory by Mr. Wragge, the other by Captain Purey-Cust on the astronomical work. The authors of these reports were admittedly experts of the highest class, they were specially invited by the Tasmanian Government to supply the information which they gave, and they spared no pains in making themselves acquainted with local conditions. Mr. Wragge spent two months in Tasmania, visiting every observing station, and suggesting and making improvements at each. Captain Cust spent a month at the Hobart Observatory, testing all the astronomical instruments, taking observations, and checking the calculations of the Government Meteorologist. It would be interesting, said Mr. Kingsmill, to know what has been recommended by these experts, and how far their recommendations have been carried out. Such information is especially necessary as the present time, when the question of transfer of observatory work to the Commonwealth Government is under consideration. It appears from what transpired at the meeting of the Royal Society on the 10th inst. that the conditions which Captain Cust and Mr. Wragge reported as necessary for the efficient conduct of the astronomical and meteorological work of the Observatory have never been provided by the Government, either as to staff or equipment. Consequently, as the Hon. N. J. Brown has pointed out, it must be made clear to the Commonwealth Government that if a transfer is made, additions to both will be required. The difficulty of the situation is enhanced by the pressing necessity for retrenchment at the present time. All are agreed as to the desirability of placing the Meteorological Department on a better footing. It seems to have been considered in the past that the department, having to deal with atmospheric phenomena, should live on air. This idea led to its being nearly starved out of existence. Yet if the work is required, it should be paid for, and the payment should bear some proportion to the skill and experience necessary to the attainment of scientific accuracy. Few who have not been trained in science, Mr. Kingsmill pointed out, can realise the quantity of labour necessary to ensure accurate results, or the worse than useless character of work in a scientific department that is nearly right, but not quite. For example, a small mistake in the time-service is more puzzling, and more likely to be misleading, than a large error, which would be obvious. What then is to be done? The most practical appears to be, that arrangements should be made for a conference of the Directors of Observatory work in the different States, and that they should be assigned the task of preparing a scheme which will satisfy both general and local requirements. There is no insuperable difficulty in the preparation of such a scheme; the problem is identical with one which has been already solved in the Dominion of Canada. There was a time, said Mr. Kingsmill, when each Province in the Dominion had its own seperate time service, and meteorological service, such as it was. Now, there is one central office in Toronto, which receives weather telegrams from over three hundred observing stations throughout the Dominion. Forecasts ,are issued daily from the central office to all the Provinces. A similar system prevailed in the United States, only on a greater scale. No meteorological service in the world was better organised than that of the United States, and on none was there so large an expenditure. Yet it is a productive expenditure, and it has often happened that a saving has been effected by the timely warning of a single storm, which would more than cover the cost of maintaining the service for a year. What has been done both in Canada and the United States, with signal success, can be done, and ought to be done, in this State. He would, in conclusion, most strongly submit for the Hon. the Premier's consideration the advisability of urging that a conference of meteorologists be appointed at an early date.

Mr. A. Risby, Warden of the Hobart Marine Board, supported the object of the deputation.

Mr. John Macfarlane (President of the Hobart Chamber of Commerce) urged that the work of the Observatory, if properly carried out, was of great importance to the shipping. The forecasts of weather, as given to the fishermen in the old country, were largely the means of saving life.

The Rev. J. B. Woollnough, M.A., M.H.A., asked had the Premier received any communication from the Federal Government as to giving Mr. Wragge facilities for his work, as we had been doing?

The Premier said he had received a telegram from Mr. Philp, Premier of Queensland, saying that if free telegrams and postage were conceded, Mr. Wragge's work could be carried on for £2,000 a year, and asking would the various States contribute that amount. He had replied, asking for information, and saying that if Tasmania's contribution was to be on a population basis, he would submit to Parliament a favourable proposal. South Australia had refused, and New South Wales had agreed to contribute. He understood that the Federal Government were willing to concede free postage and telegrams. He also understood that the Federal Government would consider in the recess—if there was one—(laughter)—the question of taking over the meteorological service. In writing to Mr. Deakin, he would bear in mind all that had been said by the deputation. He was afraid the time was not opportune for asking this Government to provide new instruments for our Observatory. He would suggest to Mr. Deakin the conference spoken of by Mr. Kingsmill.

## JULY, 1902.

The monthly meeting of the Royal Society of Tasmania was held on the 8th of July at the rooms, Argyle-street. His Excellency the Governor (Sir A. E. Havelock, G.C.S.I., G.C.M.G.), (president of the Society) presided.

### The King's Illness.

His Excellency the Governor said:—As members of the Royal Society of Tasmania, of which Her Majesty the late Queen was, and His present Majesty King Edward VII. is, patron, it was fitting they should join in expressing the feelings of public satisfaction and happiness at the news received during the last few days of the successful recovery of His Majesty the King from an illness, the result of which was watched with so much anxiety a fortnight ago. (Applause.) There was one other matter of congratulation he should like to mention concerning one of the oldest members of the Royal Society—the honour which His Majesty had been pleased to confer upon their friend Sir Adye Douglas. (Applause.) He was so well known to all in Tasmania and Australia that any words of his as to Sir Adye Douglas's place in the community or his past history would be superfluous. The honour conferred upon him in his 87th year had given pleasure and satisfaction to them, and to all Tasmania. (Applause.)

Sir Adye Douglas briefly replied.

### New Member.

Mr. Edmund Leolin Piesse, B.Sc., of New Town was elected a Fellow of the Society.

### Proposed Retirement of the Queensland Colonial Botanist.

Mr. Rodway, member of the Council of the Royal Society of Tasmania, moved the following resolution,—"That this Society hears with sincere regret the intention of the Queensland Government to retire Mr. F. M. Bailey from the position of State Botanist. It would respectfully urge that if this cannot be avoided, it may at least be delayed until the completion of Mr. Bailey's valuable work, "The Queensland Flora."

The motion was seconded by Col. W. V. Legge, R.A., and carried unanimously.

Mr. E. A. Counsel, F.R.G.S., Surveyor-General of Tasmania, who was to have taken part in a discussion on "Forest Conservation," forwarded the following telegram from Launceston : —"Please apologise for my unavoidable absence from meeting of Royal Society. Hoped to have returned on Saturday night."

### Papers.

"Notes on Unrecorded and other Minerals Occurring in Tasmania," by W. F. Petterd, C.M.Z.S., Lond. The writer, in the opening remarks of his paper said: — The following notes, in conjunction with a paper upon the subject published in the proceedings of the Royal Society of Tasmania, 1897, embraces the work done to elucidate the mineralogy of the State since the publication of the "Minerals of Tasmania," 1896. They comprise many interesting substances of more recent discovery, including one, or perhaps two, which are quite new to mineralogical science. It will be found that above 40 species hitherto unknown as occurring in this island have been added to the already voluminous catalogue, and additional localities and associations are recorded for several previously known. An important feature is the record of several complete analyses of complex substances for which I am indebted to Mr S. Pascoe, of the Magnet Silver Mining Co., and Mr. O. E. White. of Hobart, to whom I return my sincere thanks for their ready and valuable assistance. Such work is invariably a welcome addition to mineralogical investigation. and I am sure it will be duly appreciated by those interested in this field of inquiry. In many cases it is only by such means coupled with a crystallographic character that the specific identity can be obtained with reasonable certainty. It is almost needless to say that in this department much yet remains to be done before we can possess a comprehensive knowledge of the mineral known to occur in this State. The list, with descriptions and localities number 77 species, and will prove to be a most valuable addition to our knowledge of Tasmanian minerals.

Note on Eucalyptus linearis, Dehnhardt (a supposed Tasmanian species), by J. H. Maiden, F.L.S., Director, Botanic Gardens, Sydney. (Corresponding member):—

The author said he had recently received from the Imperial Natural History Museum of Vienna, a type specimen of Eucalyptus linearis, Dehnhardt, which has not been seen either by Bentham or Mueller. Usually a Mount Wellington, Tasmania, smooth-barked tree, closely related to E. amygdalina, Labill, is referred to Dehnhardt's species, which was described from a European seedling in 1829. The author describes the type, and expresses the opinion that the precise position of the plant described by Dehnhardt requires yet to be determined by Tasmanian botanists.

Mr. A. M. Lea, F.E.S., Government Entomologist, contributed a paper, entitled, "Notes on some remarkable Tasmanian Invertebrates." The writer said, under the above heading, he proposed from time to time to give notes on some remarkable Tasmanian insects, and probably other invertebrate forms of life. The notes, whenever possible, would be illustrated with sketches. The present description deals with one of the "Walking Stick" insects, being the first official record of the occurrence of the remarkable family of Phasmidæ in Tasmania. The specimen was found at Burnie, and presented to the Tasmanian Museum by Miss Dora Shoobridge, and will be known as Acrophylla tasmaniensis.

## The Great Lake.

Colonel Legge furnished the maximum and minimum temperature at the north end of the Great Lake for the month of June, 1902, compiled by Mr. F. H. Archer, Police Station, North Great Lake. The maximum was 48 degrees on the 3rd, 5th and 24th, and the minimum 15 degrees, on the 26th. The mean temperature for the month was 35 degrees.

## Forest Conservation.

A discussion took place on Mr. W. Heyn's and Mr. C. B. Target's paper on Forest Conservation.

Mr. L. Rodway spoke upon the papers at considerable length. Speaking of the apple trade, he advocated the registration of brands by the Government, and the publication in pamphlet form of results of sales. Otherwise he thought the industry would be able to take care of itself. The timber trade possessed greater difficulties, and to do much for it, the Government would have to take the whole management of it. But the Government might inquire if there was a sufficient quantity of timber to warrant the going in for a large export trade, and if there was, it would be within their province to find markets. It was hardly possible to establish an agricultural college in Tasmania at present, but there were such establishments already in Victoria, South Australia, and New South Wales, and scholarships in one of those colleges might be founded here. If, then, the scholars were numerous enough, we might find it worth while to establish a college of our own. Referring to Mr. Target's paper, he said that the oak in Tasmania had not been a success. There was a great deal to be done in planting stringy bark, which grew very rapidly. Button-grass plains were poverty-stricken—you got a foot of soil, and then came gravel.

Mr. A. O. Green said that he always compared this country with Norway: Norway, like Tasmania, is a poor country. It is mountainous, it has a broken coast line, it is largely covered with forests, but there the similarity ends. The forests of Norway produce small trees, not more than a foot to eighteen inches in diameter, and from which a plank cannot be obtained wider than nine inches, or longer than ten or twelve feet; and yet the Norwegians so prepare and classify their timber for market that it has a staple value throughout the civilised world, and is sent everywhere, including Tasmania—and the country reaps a profit of about a million pounds annually. Tasmania on the other hand, with her magnificent forests from want of the system and care that make the Norwegian industry so successful, reaps a merely nominal benefit from her much more valuable forests. Mr. Heyn's remedy for this state of affairs, summed up in one word, was education, and with this in general terms he fully agreed. Tasmanians who should know better may be found, who will run down Tasmanian timbers as worthless, whereas, if properly prepared for market, they are second to none in the world for the purposes for which they are suited. Again, people may be found in Tasmania who will stigmatise the science of forestry as a fad, and even in the present day may be found Tasmanians who will deride education, as applied to timber. Mr. Target had shown, very forcibly, the good that forests do to a country from simply existing. He went on to show that they profit several countries to the extent of upwards of a million per annum, when treated on sound commercial principles, and further pointed out how, by systematic planting, barren and profitless stretches of country might be profitably improved. There is no what is termed "theory" about this. Round our coasts there are plenty of places where our good land is being overwhelmed by the sand blown in from the sea; exactly the same thing has been overcome on the shores of the Bay of Biscay by planting pine trees. In the Bay of Biscay, not only has the sand been stopped, and a profitable industry in turpentine established, but, owing to the fact that pine trees make vegetable soil more quickly than any other trees, the sandy wastes have been transformed into fertile land. In the same way in Denmark, by the planting of pines and other trees, heathy morasses, somewhat like our button-grass plains, have become a source of revenue from the timber, and, eventually, dairy farms adding greatly to the wealth of the country. If rightly managed, we have inexhaustible supplies of timber, superior to oak and ash, for which, were it properly placed upon the market, there would be an inexhaustible demand, at remunerative prices.

Mr. G. E. Moore, C.E., also offered some observations, and was followed by Mr. A. Mault

The discussion was adjourned till next meeting, and a vote of thanks to the readers of papers was passed.

The proceedings then terminated.

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Colonel W. V. Legge said he had received a very important communication from Mr. F. H. Archer, residing at the Great Lake, dealing with the temperature of that part of Tasmania for the month of June of the present year, which he would read.

Police Station,
North Great Lake,
2nd July, 1902.

Colonel Legge,
Military Barracks,
Hobart.

Dear Sir,

I enclose herewith a record of the max. and min. temperatures for June.

Comparatively, June was very mild. The frosts were not nearly so severe as they were last year. The Great Lake is covered with about 2in. of ice, and the Little Lake 3in. But a thaw set in this morning, with a strong N.W. wind, and the ice is breaking up. We had about 18in. of snow during the disturbance "Braddon," which is rapidly disappearing. We had 6in. last year at the same date, and it lay about till the end of August. Rainfall for June, 1902, 7.985in.

There are still a number of little gulls about, but the ducks have wholly disappeared.

I am, dear sir,
Yours, truly,
F. H. ARCHER.

Max. and Min. Temperatures at North End, Great Lake, for the month of June, 1902:—

| Date. 1902. | Temperature. Max. | Min. |
|---|---|---|
| June 1 | 44 | 30 |
| ,, 2 | 39 | 28 |
| ,, 3 | 48 | 32 |
| ,, 4 | 45 | 40 |
| ,, 5 | 48 | 29 |
| ,, 6 | 44 | 30 |
| ,, 7 | 44 | 39 |
| ,, 8 | 44 | 33 |
| ,, 9 | 45 | 34 |
| ,, 10 | 42 | 29 |
| ,, 11 | 44 | 26 |
| ,, 12 | 46 | 24 |
| ,, 13 | 43 | 21 |
| ,, 14 | 39 | 32 |
| ,, 15 | 41 | 32.5 |
| ,, 16 | 42 | 35 |
| ,, 17 | 39 | 33 |
| ,, 18 | 34 | 24 |
| ,, 19 | 37 | 30 |
| ,, 20 | 38 | 23 |
| ,, 21 | 38 | 22.5 |
| ,, 22 | 36 | 21.75 |
| ,, 23 | 44 | 18 |
| ,, 24 | 48 | 23 |
| ,, 25 | 39 | 13.5 |
| ,, 26 | 37 | 15 |
| ,, 27 | 44 | 23 |
| ,, 28 | 45 | 25 |
| ,, 29 | 45 | 21 |
| ,, 30 | 43 | 23 |

Mean for month, 35deg.

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## List of Works Presented to the Royal Society of Tasmania during the Month of July, 1902.

Journal of the Department of Agriculture of Victoria. From the Department.

Journal of the Straits Branch Royal Asiatic Society, No. 37, January, 1902. From the Society.

Journal of the Society of Arts (current Nos.) From the Society.

Journal of the Royal Anthropological Society of Australasia. From the editor.

Transactions of the Royal Society of South Australia, Vol. XXVI. From the Society.

Insect Enemies of the Pine in the Black Hills Forest Reserve. An account of results of special investigations, with recommendations for preventing loss, by A. D. Hopkins, Ph.D. From the U.S. Department of Agriculture.

Catalogue of Casts, Models, Photographs, and Restorations of fossil vertebrates. From the Department of Vertebrate Palæontology. American Museum of Natural History.

Hand-list of the Genera and Species of Birds, Vol. III. By R. Bowlder Sharpe, LL.D.

Catalogue of the Collection of Birds' Eggs in the British Museum, Vol. I. Ratitæ, Carinatæ (Tinamiformes, Lariformes), by E. W. Oates. Catalogue of the Fossil Fishes in the British Museum, Part IV., containing the Actinopterrgian, Teleostomi, of the Suborders Isospondyli (in part), Ostariophysi, Apodes, Percesoces, Hemibranchii, Acanthopterygii, and Anacanthini, by A. S. Woodward, LL.D. Catalogue of the Lepidoptera, Phalænæ, in the British Museum, Vol. III. From the trustees of the British Museum.

Reports of the Evolution Committee of the Royal Society, Report I. Experiments undertaken by W. Bateson, F.R.S., and Miss Saunders. From the Society.

Calendar of the University of Sydney for the year 1902. From the University.

Geological Magazine. No. 456 N.S. Decade IV. No. VI., June, 1902. From the Society.

Annals and Magazines of Natural History, Vol. 9. No. 54, June, 1902. From the Society.

Monthly Review, No. 21, June, 1902.

The Athenæum, May, 1902.

Classified catalogue of an extensive and valuable collection of books, pamphlets, views, maps, and transactions of societies relating to Africa and African countries. Part III., July, 1902. From the publisher.

Fourth annual report of the Northern Tasmanian Anglers' Association. From the hon. secretary.

Catalogue of Indonesian Art. From Karl W. Hersemann.

Sitzung der Mathematisch —Naturwisissenschaftlichen. From the Society, Wien.

Monthly notices of the Royal Astronomical Society, Vol. LXII., No. 7, May, 1902. From the Society.

Record of the Geological Survey of New South Wales, Vol. III., Part II., 1902. From the Mines Department.

Copy of an old Mercator of 1706. From Mr. Thos. S. Read, Adelaide.

Atti della Reale Academia dei Lincei. From the Academy.

Boletein da Sociedade de Geographia de Lisboa. From the Society.

Acta Horti Petropolitani, Vol. XIX., Fasciculus 1 and 2. Flora Manchuria, Flora Korea, Lichenes Flora Rosiœ et regionum confinium Orientalium. From the Department of St. Petersburg.

Proceedings of the Royal Society, London, Vol. LXX., No. 460, May 461, June, 1902. From the Society.

Catalogue of Henry Sotheran and Co.'s Illustrated Catalogue of valuable books, beautiful old prints, and original drawings, 1902. From the publishers.

Scottish Geographical Magazine. From the Society.

Proceedings of the Washington Academy of Sciences. Papers from the Harriman Alaska Expedition, XXVIII., Hymenoptera, by W. H. Ashmead. From the Academy.

Katalog einer Sammlung von 923, Modellen in Bernbaumholz zur Elanterung der Krystallformen der Mineralien Katalog, No. 50. Petrographisches Praktikeem. Beschreibung einer Sammlung, Von 386. From Dr. Krantz.

Geographical Journal of England, Vol. XIX., No. 6. From the Society.

Geological Map of Victoria. From the Mines Department.

Victorian Naturalist, Vol XIX., No. 3, July, 1902. From the Society.

Gazette of Literature. A monthly classified list of new publications, London. From the publishers.

## AUGUST, 1902.

**monthly meeting of the Royal
ty of Tasmania was held on the 12th
gust at the Museum. His Excellency
overnor, Sir Arthur Havelock, pre-
. There was a large attendance of
ers.**

### New Members.

**W. M. Hardy and Mr. W. A. Thorpe**
elected members of the society.

### Queensland Flora.

etter was received from the Under-
tary for Queensland, acknowledging
t of a letter from this society, for-
ng a resolution in which regret was
ssed at the decision to dispense with
rvices of Mr. F. M. Bailey, Colonial
ist of Queensland, and urging that
retained till the completion of his
on Queensland flora, on which he was
engaged. In reply, the society was
ned that the Queensland Govern-
had already made arrangements for
nuing Mr. Bailey's services for six
hs from the 1st inst., in order that
ght be able to complete the work in
ion.

### North Great Lake.

onel Legge read a letter from Police
er Archer, at North Great Lake,
g that they had experienced no very
frosts during the month of July,
he lakes, with the exception of Pine
which was covered with four or five
s, had been remarkably free from
The only birds to be seen on the
Lake now were the gulls. They ap-
d to be quite as plentiful as they
in the summer. The grey thrush
here all the winter, but not plenti-
lso a few white magpies and wattle-
Ground larks were plentiful, and
v-throated honey-eaters were not
. There were also butcher-birds,
s, and emu wrens. He had not
d the white hawk up there. He had
d the brown hawk in the spring,
along the edge of the lake and
the islands, apparently looking for
and water fowl. At present, most
days were bleak and sunless, and
inds unpleasantly cold. During July
inimum temperature was 19deg. on
th, and the maximum 48deg. on the
mean temperature for the month,

**Max. and Min. Temperature at Great Lake, North, during July, 1902:—**

| Date. 1902. | | Temperature. Max. | Min. |
|---|---|---|---|
| July | 1 | 43 | 26 |
| | 2 | 41 | 30 |
| | 3 | 43.5 | 36 |
| | 4 | 38 | 33 |
| | 5 | 40 | 31 |
| | 6 | 36 | 25 |
| | 7 | 34 | 22 |
| | 8 | 35 | 23 |
| | 9 | 37.5 | 29 |
| | 10 | 39 | 30 |
| | 11 | 39.5 | 30 |
| | 12 | 38 | 24 |
| | 13 | 34 | 23 |
| | 14 | 37.5 | 23 |
| | 15 | 38 | 23 |
| | 16 | 37 | 28 |
| | 17 | 38 | 29 |
| | 18 | 42 | 32 |
| | 19 | 44 | 28 |
| | 20 | 43 | 31 |
| | 21 | 44 | 32 |
| | 22 | 39 | 26.5 |
| | 23 | 40 | 28 |
| | 24 | 48 | 28.5 |
| | 25 | 38 | 22.5 |
| | 26 | 44 | 33 |
| | 27 | 40 | 34 |
| | 28 | 42.5 | 35 |
| | 29 | 41.5 | 31.5 |
| | 30 | 39 | 19 |
| | 31 | 40 | 31 |
| Mean for month ... ... ... ... ... | | | 34 |

### Governor Denison.

The Secretary read the following letter from Mr. H. E. Smith:—"I have very great pleasure in presenting to the Royal Society of Tasmania a splendid engraving, a full length portrait of the late Sir Wm. Thos. Denison, who was Governor of this colony from January 28, 1847, to January, 8, 1855, as a token of esteem and affection in which he was held by me." Mr. Smith, the secretary said, gave a very interesting account of Sir Wm. Denison, and it was decided that the valuable notes furnished by Mr. Smith should be forwarded to the Historical section of the Royal Society of Tasmania.

### Tasmanian Forestry.

The adjourned discussion on Tasmanian forestry took place.

Colonel Legge made some observations, in the course of which he expressed a desire to see a Forest Conservancy Department created in this State, and expressed his regret at the extent to which "ringing" was indiscriminately practised in Tasmania.

Mr. A. Mault also spoke.

Hon. W. Crosby, M.L.C., said that Mr. Heyn, the timber expert from England, was entitled to the thanks of the Society for the two valuable papers which he had written, and that had caused such an important discussion on the timber industry of Tasmania. Two cargoes of timber for the Dover (England) habour works had already arrived, and had far exceeded the expectations of the contractor. Mr. Deardon (the Government Timber Expert) had visited West Australia, and examined the Jarrah timber, and was satisfied that Tasmania would hold its own against West Australia as a timber-producing and exporting State.

The discussion then closed.

### Calcareous Nodules.

Professor Hogg, M.A., exhibited, and made some observations on, some calcareous nodules obtained at New Town, the interest in which arose on account of the perfection of the geometrical form.

### Tasmanian Timbers.

Mr. A. O. Green read a paper on "Tasmanian Timbers: Their Qualities and Uses, with Tables, Weights, Gravities, Strength, and Cost, in Comparison with European Timbers." The following is a resume of the paper, which was an interesting and exhaustive one, illustrated by lantern slides, prepared by Mr. J. W. Beattie, of Hobart:—After giving the terms upon which saw mill area and water rights may be taken up, each kind of tree available for timber is described in detail. Then follows a most exhaustive set of tables; in which it is shown that Tasmanian timbers do not vary as to weight and strength, as do the deal, oak and other European timbers. After this, results are given from experiments, which appear to have been carried out with very great exactitude by the author, showing the weight, deflection, breaking weight, transverse strength, modulus of elasticity, constant for stiffness of beams, and the breaking weight for one foot by one inch, by one inch beams, supported at the ends and loaded in the middle, for nine sorts of Tasmanian timber and two imported pines; and, for the sake of comparison, the same data are shown for English ash, beech and oak. All the timbers are arranged in order of their transverse strength, and it is noticeable that the ash, beech and oak come at the bottom of the list, being little more than half as strong as the seasoned stringy bark, which heads the column. The next table shows the same timbers arranged in order of stiffness; here, again, the fact becomes apparent *that Tasmanian* timbers are not only stronger and less variable in strengt European timber, but are also stiffe whole of the formulae and mode of ing to obtain them are carefully give fully explained in plain English. paper is illustrated with splendid graphs of the fracture in each case. author then goes on to show that E ean timbers are subject to warpin shrinkage. The way that this is come in English practice is also s and a very fair case is made out, t the same skill were used in seasonin manian timber as good a result co obtained as is done with English oak. are given of the weights of sawn an stuff, and of timber in the log. A plete list of Tasmanian timber trees the size and quality of the wood the produce, a botanical description o chief varieties of gum trees and a index were also given.

Mr. Green explained a number periments which he had made wit manian timbers, and said it would immense value if still more careful trying ones were made, so as to redu capabilities of Tasmanian timbers exact science.

### An Interesting Picture.

Mr. A. Morton threw on the wall, Mr. Green had concluded his lect fine lantern picture of His Excellen Governor decorating Lieut. Bisdee the V.C. at the Domain on the pre day.

### Vote of Thanks.

A vote of thanks was passed to readers of papers.

The proceedings then terminated.

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The following is a list of works a to the Royal Society Library durin month of August, 1902:—

Atti della Reale Academia della cei. N. 12. From the Departmen

Agricultural Gazette of New S Wales, vol. xiii., pt. 8, August, 1

Blackie and Son's catalogues of (a) classified list of scientific, m matical, and technical publications list of books, 1901-2, (c) general li ture, educational works, (d) quar list, midsummer, 1902, (e) educat circular. From the publishers.

Boletin Mensual del Observatorio teorologico, Central de Mexico. the Department.

lletin, Geological Survey West
·alia, No. 6, 1902. From the De-
nent.

lletin of the American Museum of
ral History, vol. XVII., pt. 2; The
ington Californian Expedition,
u Myths, by Roland B. Dixon.
. the Department.

lletin of the Museum of Compara-
Zoology at Harvard College, vol.
No. 2. The early development of
—a study of cell lineage and germ
s, by M. A. Bigelow. From the
ge.

talogue of atlases, maps, globes,
illustrations, etc. From Messrs.
nd A. K. Johnston, Edinburgh.

:alogue of legal, commercial, and
works published and sold by Ef-
m Wilson, London. From the
sher.

graphical Journal, London, vol.
No. 7, July, 1902. From the So-

ological Magazine, No. 457; In-
Mg. Manuel E Pastrana rinde l
tario de fomento Texto. Plates,
:o, 1901. From the Department.

rnal of the Royal Microscopical
y of England, pt. 3, June, 1902;
al of the Department of Agricul-
cf Victoria. From the Depart-

rnal of the Society of Arts, July
02. From the Society.

noir, IV., pts. 4 and 5. Scienti-
sults of the trawling expedition of
.S. Thetis off the coast of New
Wales in February and March,
From the Trustees Australian
m.

noirs and Proceedings of the Man-
r Philosophical Society, vol. 48,
., 1901-2. From the Society.

thly Weather Review, vol. XXVI.,
April, 1902. From the Meteoro-
Department, Canada.

thly Notices of the Royal Astro-
l Society, London, vol. LXII.,
June, 1902. From the Society.

eedings of the Royal Society,
n, vol. LXX., No. 462, July 8,
From the Society.

Proceedings of the Royal Society of Victoria, Vol. XV., No. 8, pt. 1, 1902. From the Society. Proceedings of the Royal Institution of Great Britain, vol. XVI., pt. III., No. 95. From the Institution.

Proceedings of the Linnean Society of New South Wales for the year 1902, pt. 1, containing papers read in March to May (in parts), 1902, vol. XXVII., No. 105. From the Society.

Results of Rain, River, and Evaporation. Observations made in New South Wales during 1899 by H. C. Russell. Current papers, No. 6; Recurrence of rain, the relation between the moon's motion in declination and the quantity of rain in New South Wales. From H. C. Russel, Government Astronomer.

Resources Vegetales des Colonies Francaises dans les collections de l'office Colonial du Ministere des Colonies, par Gustavo Niederlein. From the Author, Philadelphia.

Results of observations in meteorology and terrestrial magnetism made at the Melbourne Observatory and other localities in the State of Victoria, Australia, from the 1st July to 31st December, 1901, by P. Barrachi, Government Astronomer. From the Observatory.

Synopsis Filicum, or a synopsis of all known ferns, including the Osmundaceæ, Schizœaceæ, Marattiaceæ, and Ophioglossaceæ, by the late Sir W. Jackson Hooper and John Gilbert Baker, London, 1874. From Mr. Thos. Stephens, M.A., F.G.S.

Scottish Geographical Magazine, vol. XVIII., No. 7, July, 1902. From the Society.

Victorian Naturalist, vol. XIX, August, 1902. From the Society.

Voyage Towards the South Pole in the years 1822 and 1824, by Jas. Weddell, London, 1827. From Miss Woodin

World's Fair Bulletin, vol. 3, No. 9. From the Department.

The Wombat, vol. V., No. 3, July, 1902. From the Society.

## SEPTEMBER, 1902.

The monthly meeting of the Royal Society of Tasmania was held on Monday evening, His Excellency Sir Arthur Havelock presiding. Apologies were read from Mr. T. Stephens, M.A., senior vice-president, and Mr. A. Mault.

The President introduced the Bishop of Tasmania, and said they would find His Lordship a valuable member of the Society. (Applause.)

On the nomination of the Hon. N. J. Brown, Messrs. R. M. Johnston and Bernard Shaw, the Right Rev. Bishop of Tasmania, Dr. Mercer, was proposed for election as a Fellow of the Society at the next monthly meeting.

The following were elected Fellows of the Society:—Dr. G. F. Read, assistant surgeon, New Norfolk Asylum; Mr. E. H. Wilkinson, engineer, Metropolitan Drainage Board; and Mr. F. W. Reid, director of School of Mines, Zeehan.

### Correspondence.

Colonel Legge read a letter from Mr. F. W. Archer, enclosing list of temperatures for August at the Great Lake, in which it was stated that the Great Lake was covered with two or three inches of ice from August 12 to August 17, and that ice about one foot thick had been seen piled up on the shore after a storm. The thermometer, too, had been nearly down to zero. Britten's and Pine creeks, the writer stated, were suitable for spawning, but unfortunately just at the beginning of the spawning season the Great Lake was too low to allow the fish to enter the creeks. The level of the lake might, however, be raised about one foot by a dam across the Shannon, and would meet the difficulty.

### Papers Discussed.

Mr. Target replied briefly to the criticisms and obbservations passed upon his paper on "Forest Conservation," which had been read at a previous meeting.

A discussion took place on Professor Hogg's paper, "Tasmanian Nodules," which was read at the previous meeting. Mr. Morton read some notes by Mr. T. Stephens on nodules which he had found in coal measures at New Town and Colebrook, and Mr. R. M. Johnston explained that he had examined Professor Hogg's nodules, thinking that there might be something volcanic about them, but he could not discover that they were other than some form of concretion. He hoped that some day Professor Hogg would be enabled to throw more light upon them. The Professor, in reply, said they were probably the result of some chemical attraction of which he could say nothing.

Mr. A. O. Green's paper, "Tasmanian Timbers," was also discussed. Mr. Target suggested the carrying out of experiments as to shrinkage of timbers. Mr. Johnston said Mr. Green had extended their information on timbers that were not formerly experimented upon, and his work was deserving of recognition. Professor Hogg thought Mr. Green had been a little hard on English timbers. In valuing timbers, it was not quite scientific to add together results obtained from different sized timbers, and call that the specific transverse strength of a beam. Col. Legge pointed out that so far as shrinkage was concerned, Tasmanian timbers were not unique. He cited an instance of English oak having shrunk after a wetting, though it had been standing in the interior framework of a house for many years. Mr. Green, in reply, explained that Kircaldie had tested a blue gum log, 9 inches square, which broke at within 16½ per cent. of what he (Mr. Green) had put as the breaking strength of a blue gum beam, one inch specimen. He saw nothing to make him doubt that his experiments were fair approximations.

Some notes on a species of eucalyptus new to Tasmania — E. Macarthari, Deane and Maiden—were furnished by Mr. J. H. Maiden, of Sydney.

### Practical Astronomy.

Professor McAulay read a paper on "Practical Astronomy in Tasmania, and a Proposal for a School Thereof." Having referred to the enthusiastic labours of Mr. Abbott and Mr. Biggs in the cause of astronomy in the past, the Professor referred to the transit of Venus in 1874. The main interests of that transit were —of course—world-wide, but Tasmania (did she but know it) had herself benefited by the visually insignificant fact that in 1874 Venus passed between the earth and the sun, and therefore was visible as a dot on the sun's face. Tasmania's gain was owing to the fact that on account of her valuable position in the far south, in this matter of finding the sun's distance, as in many other astronomical respects, she was at once seen to be a place where the necessary astronomical observations ought certainly to be made. But the Astronomer Royal of England said "No, we do not know her longitude sufficiently accurately"—and that was true, we did not. America came to the rescue. "Why not," said America, "find the longitude accurately?" So they came, found the longitude, observed the transit, and went. The result with regard to longitude was that for all time we knew the following fact:—That a certain piece of masonry (at present in existence in the Barrack-

is 9min. 25.66sec. east of the centre
ransit instrument in Melbourne.
ce of masonry in question was
ery precious to Tasmania, and if
wed it to become undecipherable,
ld be put to much expense and
ouble once more to determine her
le. As for the uses and desira-
f practical astronomy in such a
ity as ours, it was imperative to
e time as accurately as possible.
rs depended upon the time for
sition, and it was absolutely neces-
at we should be able to give them
e time as they received in Sydney,
ey received it from us, they could
n their chronometers' rates at sea,
y cannot obtain these rates other-
n extreme cases it was sometimes
ry to know the time to one second,
r to make the necessary provision
ans all the difference between life
th to many souls. That it was high-
able in the interests of science to
h a practical School of Astronomy
nania was illustrated by the dis-
which arose in connection with
ke Bequest., The whole of those
ons had a most direct bearing on
sent position. The Leake Bequest
00 purported to establish a School
onomy, but, unfortunately, the
proved not available for that pur-
t present, practical astronomy in
ia, he was sorry to say, consisted
f what the Government was pre-
o believe was useful; that was to
consisted of keeping time for the
sland by the transit instrument at
servatory. As accurate time was
it was possible to keep by such
and it was telegraphed every day
many points in Tasmania auto-
ly from the Observatory clock.
ll—the mariners' signal—was not,
oubtedly should be, dropped auto-
ly. There was no standard clock
bservatory, and the public of Tas-
depended on the charity of two pri-
tizens for their clock service. The
ological Department was over-work-
er-manned, and under-paid. and it
vitable that under those conditions
its work was not as efficiently per-
as it would be were its resources
te. He submitted for considera-
e following suggestions:—"(a) No
o be diverted from the Meteorolo-
epartment. (b) The Meteorological
arters to remain in the Barrack
, as at present, even if the Square
red, as lately suggested by the
r of Lands. (c) The Government
mical work to be handed over to
iversity on certain conditions. (d)
astronomical instruments to be
rred to the University grounds, and
ed there, at the cost of the Govern-
(e) Loan of the transit instrument in the possession of the Melbourne Observatory, which for many years was lent to Adelaide, to be asked for. (f) Automatic connection between the Observatory clock and the time ball to be established by Government. (g) Proper clocks to be provided by the Government. (h) The University to grant site of new Observatory, and site of a residence for a new officer. (i) The new officer to have the following duties:—(1) Observing time for the island; (2) teaching in the University astronomy, surveying, practical physics, and such parts of the mining course as it is possible and desirable for him to do. (j) The salary of the new officer to be £350 a year, of which the Government provide £150 and the University £200. The Observer would have to reside at the University, and might perhaps live in the house at present occupied by Professor Williams. If he lived rent free, the University's contribution to his salary should, perhaps, be only £175." The University was faced with the unpleasant reality that it could not continue to teach what it professed to teach without the appointment of some such officer. He recommended merely that his appointment should be seized as the opportunity of starting what in the future might be of inestimable value to the whole world—the establishment of an efficient School of Astronomy, in a high southern latitude, and in a climate peculiarly suitable for astronomical work.

Owing to the lateness of the hour, the discussion of the paper was postponed.

On the motion of the president, a vote of thanks was passed to Professor McAulay, and the meeting closed.

List of works presented to the Royal Society of Tasmania's Library during the month of September, 1902:—

Annals and Magazines of Natural History, August, 1902; Annals of the Royal Observatory Edinburgh, Vol. I., from the Society; Atti della Reale Academia dei Lincei, Vol I., Fas. 2, etc., from the Society; Agricultural Gazette of New South Wales, Vol. XIII., Pt. 9, September. 1902, from the Department; Boletin Mensual del Observatorio Meteorlogico Central de Mexico, from the department; Berichte der Commission fur Oceanographische Forschungen Expedition, S. M. Schiff, Pola M. das Rothe Meer Sudliche Halfte. September, 1897, Marz, 1898, Beschreibender Theil verfasst von Paul Edler von Pott, with chart and four parts, from the Hydrographer, Wein Boletin da Sociedade de Geographia de Lisboa, 19 Serie, Nos. 4 and 6, from the Society; Emu, the, Vol.

II., October, 1902, Pt., from the Society; Geographical Journal of the Royal Geographical Society, August, 1902, Vol. XX., No. 2, from the Society; Geological Magazine, August, 1902; Ibis, July, 1902: Journal of the Royal Microscopical Society, 1902, Pt. 4, August, from the Society; Journal of the Royal Society of Arts, from the Society; Journal and Proceedings of the Royal Society of New South Wales, Vol. XXXV.. 1902, from the Society; Journal of the Linnean Society (London), Zoology, July 1. Vol. XXVIII., No. 185, Vol. XXXV., Botany, No. 245, July 21, 1902, from the Society; Memoirs of the Geological Survey of India, Vols. XXX., Pts. 3 and 4, XXXI., Pts. 2 and 3, XXXII., Pt. 1, XXXIV., Pt. 1, from the Society; Nature, June, 1902, Observations made at the Hongkong Observatory in the year 1901, by W. Doberck, from the department; Proceedings of the Royal Society (London), Vol. LXX., No. 465, August, 1902, from the Society; Proceedings of the General Meetings for Scientific Business of the Zoological Society of London, 1901, Vol. II., Pts. 1 and 2, from the Society; Proceedings of the Washington Academy of Sciences (papers from the Harriman Alaska Expedition), XXIX., "The Mosses of Alaska," from the department· Proceedings of the Royal Geographical Society of Queensland, Vol. V., Pts. 1 and 2, Vol. XI., XV., XVI., from the Society; Quarterly Journal of the Geological Society, Vol. LVIII. ,Pt. 3, No. 231, August, from the Society; Records of the Australian Museum, Vol. IV., No. 725, August, 1902, from the trustees: Report of the Department of Lands and Survey, Tasmania, for 1901-2, from the Surveyor-General; Report on Exploration of North-West Kimberley, 1901, by F. S. Brockman, from the Surveyor-General; Royal Society of England, Reports to the Malaria Committee, 7th series, August 15, 1902, from the Society; Report of the Department of Mines, Western Australia, for the year 1901, from the department; Scottish Geographical Magazine, from the Society; Science of Man, Journal of the Royal Anthropological Society of Australasia, from the Society: Transactions of the Zoological Society of London, Vol. XVI., Pts. 3 and 4, October 1901, April, 1902, from the Society; Transactions and Proceedings of the New Zealand Institute, 1901, Vol. XXXIV., from the Institute; United States Department of Agriculture, Division of Entomology:—(a) Some Insects Injurious to Vegetable Crops, being a series of articles dealing with insects of this class, by F. H. Chittenden; (b) Principal Insects Liable to be distributed on Nursery Stock, by Nathan Banks; (c) Cockroaches : (d) The Silver Fish; (e) The White Ant; (f) The House Centipede, by C. L. Marlatt; (g) Hydrocyanic Acid Gas against Household Insects, from the Department of Agriculture; Victorian Naturalist, Vol. XIX., No. 5, September, 1902, from the Society.

## OCTOBER, 1902.

monthly meeting of the Royal So- of Tasmania was held on Monday ng, October 13, His Excellency the rnor presiding. There was a fair dance. Apologies for non-attend- were received from Messrs. Stephens president), A. Mault, Bernard Shaw, olonel Legge.

Hon. Secretary read a letter from p Montgomery, dated London, Aug- l, in which the writer stated that he asked Mrs. R. C. Patterson to take he picture which Mr. Sydney Hall indly presented to the Royal Society. picture, which was exhibited at the ng, represents almost the last ap- nce of the late Queen Victoria on a c occasion, very shortly after she had "the men in khaki" returning from ar.

the nomination of Messrs. R. M. ton, B. Shaw, and N. Brown, A., Dr. Mercer, Bishop of Tasm nia, nanimously elected a member of the y. His Lordship, in returning s, said he trusted to take some part e good work of the society.

H. C. Kingsmill opened a discussion of. McAulay's paper, read at the us meeting, on "Practical Astron- n Tasmania." Notwithstanding de- e and inadequate instruments, cor- ime, he pointed out, had been kept bart Observatory, and he saw no n why astronomical and mete- ical work should not continue to be cted by the one director, as was the n the other Australian States, save island, and in Canada. To separate vo, as suggested by Prof. McAulay, nsferring the astronomical work to niversity, would tend to weaken

Professor Hogg saw two difficulties in the way of founding a really valuable school of astronomy in Tasmania. One had to do with money, and the other with men—the finding of qualified men to conduct the work of the school. Besides, in starting an Observatory on the best lines, they would have to deal with subjects like magnetism, etc., and any site in the University grounds would be very unsuitable.

Professor McAulay admitted that, for serious magnetic observations, neither the University grounds nor the present site of the Observatory, were suitable for the purpose. As there was no school of astronomy in Australia, his idea was that if a beginning were made by Hobart now, the school might grow valuable in the future.

A paper by Dr. J. Jamieson, of Melbourne, on "Typhoid in Hobart and Melbourne, and the Influence of Drainage on its Prevalence," was read by Dr. Gregory Sprott. After referring to the enormous benefits to be derived by Hobart from a good sanitary reputation, Dr. Jamieson is forced to admit that, up till quite recent times, Hobart shared the evil fame of Melbourne as a hot-bed of fever. The advantags of a sewerage system were dwelt upon, and the doctor leaves it for Hobart to decide whether it is not a grievous mistake to allow present conditions to continue longer than is absolutely necessary.

Mr. E. H. Wilkinson read a paper on "Sewage Purification and Disposal," in which he dealt with the treatment of sewage in the United Kingdom, and other parts of Europe.

A vote of thanks was passed to the readers of the papers.

## TYPHOID AND SEWAGE.

ecial meeting of the Royal Society smania was held on the evening of er 27, 1902, at the Museum, His Ex- cy, the Governor, Sir Arthur Have- presiding. The Right Rev. Dr. r, Bishop of Tasmania, was amongst present.

business of the evening was a dis- n on papers on "Typhoid," and ge Disposal," by Dr. Jamieson, of urne, and Mr. E. H. Wilkinson, of t, respectively.

G. Sprott said that the paper con- ed by Dr. Jamieson was a very valuable one, by a reputed authority on health matters. There were two points in the paper. The cosmic influence reduced itself to a question of temperature. Mr. R. M. Johnston said that spots on the sun increased the tendency to typhoid in certain years. That was purely theoretical, but it was certain that there were many more cases of typhoid in the summer than at any other time of the year. It was now generally agreed that the bacillus was in the polluted soil, and in summer spread more rapidly. He exhibited a chart showing the seasonal rhythm of typhoid in Hobart during the years 1896-97-98. The other cause of typhoid fever was want of good drainage. This might not cause typhoid, but for the pollution of the soil by sewage whereby the bacillus was propagated. He showed a chart of the annual death rate of typhoid fever per 10,000 persons living in Munich, England and Wales, Sydney, Hobart and Melbourne. The chart showed that typhoid fever was five times less where there were good sewers than in the places that were without, or had imperfect sewerage. Without a complete and perfect drainage, the typhoid rate in Hobart would not be reduced; and when such a system was secured, it would be some years before the soil was restored to its natural condition, and in the meantime typhoid would occur. Objection to the sewage being discharged at Macquarie Point was a matter of sentiment, but he should rather see the sewage treated in a septic tank before it was discharged into the Harbour. Hobart was a very healthy place, but there was no reason why it should not be made more healthy. The general death-rate was low, but that was the result of our good climate, and the outdoor life of the citizens, rather than good sanitary surroundings.

Mr. R. C. Patterson, M.H.A., Chairman of the Metropolitan Drainage Board, said: — I was sorry I was unable to be present when Mr. Wilkinson read his paper on the disposal and purification of sewage, but I have since had an opportunity of studying it, and I am satisfied that no more important practical subject could have been brought before the society at the present juncture. I am glad that Mr. Wilkinson has been able to devote so much time and labour to the preparation of this paper, as it cannot fail to be of great service to the cause we all have so much at heart, viz., the proper and efficient underground drainage of Hobart, and the adequate and satisfactory disposition of its sewage. I trust that later on, when the plans and estimates are completed, and before the question goes to a poll of the citizens, he may see his way clear to give a series of popular lectures in different parts of the city, so that the public mind may be educated on this most important matter. I have so recently dealt with the question of drainage at length in another place, that I do not propose to take up your time further than by dealing with one or two practical aspects of the question, which cannot be too much insisted on. We all know that nature will get rid of dead organic matter without any chemical treatment whatever, whether such matter be discharged into the sea or placed upon the land, and that it will do so without offence, *provided that her* capabilities were not overtaxed, and it follows that one of the most important questions we have to consider in Hobart, in discussing the problem of the disposition of the sewage, is whether the volume of water into which it was proposed to discharge crude sewage at Macquarie Point, was sufficient for adequate solution, and whether the tidal currents were strong enough, and constant enough, to enable the matters in solution and suspension to be carried out seaward sufficiently far to prevent any deposition of their constituents upon the adjoining foreshores, or of otherwise fouling the harbour. That the volume of water into which it was proposed to discharge crude sewage at Macquarie Point was sufficient for adequate solution there could be no manner of doubt, but there was a doubt in many minds as to whether the tidal currents were strong enough, and of sufficient constancy, to enable the matters in suspension to be properly dealt with, so that, once discharged, nothing more should be seen or heard of them. And a pressing business before the Metropolitan Board at the present moment was to get this point settled once and for all, by means of experiments made with floats dropped into the river at Macquarie Point, at all states of the tide, and in all sorts of wind and weather, so that we might be able to ascertain the laws regulating the course and speed of the currents, and on what shores, if any, the floats would find a resting-place. Such a series of experiments are now being instituted by Mr. Wilkinson, and if the result of these experiments should be such as to leave any doubts as to the sufficiency of the tides and currents to deal properly with the matters in solution and suspension in the crude sewage, then the clear duty of the Metropolitan Board would be to arrange that the sewage should be properly purified before being discharged into the sea. And here will come in the educational value of Mr. Wilkinson's paper, with every word of which I agree. The recent inquiries made by me in England have shown how great a change has come over the ideas of sanitary engineers with regard to the purification of sewage during the past 10 years, and which amounts to no less than a complete revolution. Where hundreds of thousands of pounds were being spent throughout the kingdom upon the installation and maintenance of irrigation farms, precipitation processes by chemical treatment, and other schemes, this new biological process, so clearly described by Mr. Wilkinson, had come to the rescue of the ratepayers, and had proved so successful and economical in practice, as to do away with the necessity of chemical treatment in any form whatsoever. In a recent report to the Sutton District Council, Mr. Dibdin, the distinguished Sanitary Engineer, after describing the process in detail, claimed that the solution of the problem of purifying sewage had a monetary value to the kingdom of not less than £60,000,000. However that may be, it is generally conceded that his biological experiments at Sutton, which were all conducted on a working basis, had settled the question of the economical and efficient purification of sewage for all time. Certainly, no ordinary and uninstructed observer could inspect any illustration of the septic system of purifying sewage, combined with bacterial treatment of the effluent without being struck with the obvious and extraordinary amount of purification obtained. The crude sewage could be observed discharging direct from the main sewer into the settling tanks, and the effluent therefrom passing through the filter beds, and emerging from the outlet in the form of a clear and pellucid fluid, which the casual observer could not distinguish from the clearest spring water. I must admit it was to me a complete revelation. Before concluding, I should like to say a few words about the site of the proposed outfall which the Metropolitan Drainage Board has definitely and finally fixed at Macquarie Point, and as to which a certain amount of uninstructed and unreasoning opposition has manifested itself. The float experiments made by Mr. Mault some 12 years ago convinced him that Macquarie Point was in every way suitable as a site for the outfall. Mr. Napier Bell, later on, came to the same conclusion, and if the additional and more exhaustive float experiments now being undertaken should confirm their conclusions, there can be no reason whatever why crude sewage should not be discharged into the estuary at that point. Whether it would not be advisable, as a matter of sentiment, to disarm a certain amount of hostility, and conciliate popular prejudice, by passing the sewage through septic tanks and bacterial filters before it is discharged into the river, is a question which the board will no doubt take into serious consideration when the detailed estimates are before them, and before the matter is remitted to a poll of the citizens. But of one thing there is no doubt, and the sooner it is understood the better. If we are to have underground drainage at all in the near future, the outlet must be at Macquarie Point, for no other scheme, with the outfall at One Tree Point, is practicable or possible at the present time, as the cost would be prohibitive. It is well known that the people of Queenborough decided long since not to throw in their lot with the metropolitan drainage scheme, nor would they agree to contribute one penny towards the expense of making the surveys or preparing plans and estimates of the cost of the undertaking, so that even if One Tree Point ha been selected as the site of the outlet ther was no guarantee that the board woul derive any revenue from Queenboroug that would have been at all commensurat with the extra cost of the work, and great and intolerable burden would hav been laid on the shoulders of the taxpayers of Hobart. Under the present metropolitan scheme, we have 35 acres of low lying land, the sewage of which will hav to be pumped into the main sewer, th greatest lift being only 20ft. With On Tree Point as the outlet we should hav had 135 acres of low-lying area to pump with a lift of over 50ft., and the cost o maintenance would have been considerably more than double that of the adopted scheme. The cost of the main outfall sewer, with Macquarie Point as the outlet, independent of branch mains, is estimated at £12,000. The cost of the main outfall sewer, with One Tree Point as the outlet, is estimated at over £60,000, so that on the score of cost alone it would be impossible to carry such a scheme fo many years to come. Both Messrs. Mault and Napier Bell agreed that Macquarie Point was a suitable place for the outlet, and this at a time when the bacterial system of treating sewage had no practical existence. How much more emphatic would be their recommendation if they were consulted to-day in the light of what has been accomplished for the purification of sewage by septic tanks and bacterial filtration. I cannot do better than bring my remarks to a close by quoting the dictum of the latest authority the board has engaged on this matter, viz., Mr. Wilkinson, who winds up the able and interesting paper he read before the Society in these words: "From the configuration of the City of Hobart and its environs, and from an engineering point of view, the natural place for discharging the sewage was at Macquarie Point, where there was deep water, enhanced by an ample tidal flush. With the expenditure of a few thousand pounds over and above the sum required for a complete system of sewerage, the sewage of Hobart could be rendered quite innocuous and purified to such an extent that the waters of the harbour would always retain their present standard of purity."

The Bishop of Tasmania said that in Manchester and Gorton the question of sewage was an acute problem, and he had been a member of one sanitary association and president of another in those places. It was practically agreed by all the authorities that the typhoid bacillus was bred in polluted soil, and in virgin soil died in a comparatively short time. Moisture, too, had a great deal to do with it. So had flies; they loved the polluted soil, and had been traced from it to the people's homes. When he was coming to

Hobart he was told that typhoid would not live in it, but on reaching Tasmania he found that two children of Bishop Montgomery's had been laid up with it, and that one of them died. He had been in a great many cities on the Continent of Europe, including Cologne, which was famed for its foul and beautiful smells, and he could say that the smells of Hobart were quite as bad as those of Cologne. On one occasion, while going to one of the Hobart churches to preach, he got a smell which remained with him during half the service. Hobart was a long way behind the age in the matter of sanitation. The cobble stones of the channels retained the sewage in their interstices, and if the smells were so bad in the cold weather, what must they be in the hot weather? At Bishopscourt, when he went there, he saw adjacent a lovely creek coming down from the mountain, but he was told that when the summer weather had set in, it would become a filthy sewer. As to the pan system, it was beneath the dignity of a community of 40,000 people like Hobart to have it. He indicted it on the ground of costliness alone. They had the same system at St. Helens, Lancashire, and it cost 2½d. per head per week, but he was told that in Hobart it cost 6d. per week. He cited statistics showing that zymotic disease decreased in cities as the water-carriage system was used. An epidemic of fever in 1900 in South Africa was directly traced to the operations of flies, and at Gorton, where he had come from, a table was kept showing when the flies and the typhoid came and went, and it was seen that the one exactly agreed with the other. No one was safe where the flies were. Hobart was a lovely place, but let them make it more lovely still. The open sewers of the city were a disgrace to it. It was not a matter of the death-rate but of the typhoid rate. He strongly appealed to the authorities to take action in this matter.

Mr. A. Thorpe, Alderman G. E. Moore, Dr. E. J. Crouch, Mr. Target, and Mr. A. R. Green also took part in the discussion.

Mr. E. H. Wilkinson, Engineer of the Metropolitan Drainage Board, showed a number of lantern views illustrating the sewage works at Sydney, and went on to say that the existing sanitary conditions at Hobart were most unsatisfactory. It was the old tale of impure air and water, owing to defective drainage. The positions of some of the dwelling houses were quite unsuited for human habitations. The configuration of the city told any engineer that the natural outfall for the drainage was Macquarie Point. The tides at Hobart were very regular, and the mean average difference between high and low water was 3ft. 9in. There was nothing sentimental about septic tanks; they were scientific facts. They purified sewage without bacterial beds. It was intended to take the Hobart sewage into very deep water, where it would get the full benefit of the tidal flush.

Some ladies, who were members of the old sanitary society of Hobart were present, and the president invited them to contribute to the discussion, but no response was made. He, however, asked them to continue the useful work which he was told they had done in times gone by.

A vote of thanks was passed to the speakers, and the proceedings then terminated.

# SUGGESTIONS FOR THE ESTABLISHMENT OF A TASMANIAN SCHOOL OF FORESTRY AND AGRICULTURE.

BY WILLIAM HEYN,

(Timber Department, Admiralty Harbour Contract Works,
Dover, England.)

Read 12th May, 1902.

In the paper on "The Present and Future Prospects of Timber in Tasmania," which I had the honour to read at a meeting of the Royal Society of Tasmania, on the 29th April, 1901, I ventured to express my firm conviction that a Tasmanian School of Forestry and Agriculture was absolutely necessary if the treasures of vegetable wealth which exist in your Island are to be properly exploited, so as to yield a remunerative return for the time, labour, and money expended on them.

It must, I think, be painfully evident to anyone who has seriously studied the subject which, in my opinion, is of such vital importance to Tasmania, that the unscientific and unreasoning manner in which forestry and agriculture has been conducted there for the last 15 or 20 years has materially hindered their proper development, has led to the destruction and waste of valuable produce, and prevented the attainment of results which, under scientific and technical treatment, would have been satisfactory, not only to those who are occupied in these pursuits, but to the community in general.

As the world advances in civilisation and population, and the "struggle for life" becomes more imperious and necessary, competition, of ever increasing intensity and ubiquity, manifests its presence with new inventions, new methods, and better appliances.

Those who continue to follow the now antiquated ideas and systems in vogue some years ago will find themselves outdistanced in the fierce race of life, and learn, perhaps too late, that "the survival of the fittest" is the ultimate result of the struggle, and that their old-fashioned and unreasoning efforts have neither benefited themselves nor others

We cannot shut our eyes to the fact that in every branch of business and industry the most important improvements and developments are being introduced daily, requiring careful scientific, technical, and practical teaching, training, and study to enable us to understand them thoroughly, to adapt them to our own requirements, and to profit by these new facilities for the promotion of commerce in our own interest and for our country's benefit.

Quite lately most important changes have been introduced into your own export business. Quick steamers, fitted with refrigerating machinery and chambers, call weekly at Hobart, enabling you to deliver your splendid fruit in good condition in the markets of England and the Continent, at a period of the year when such produce, if of good quality, ought to realise a remunerative result. Have you profited by this grand opening for your fruit trade, and have satisfactory results been obtained by producers and exporters?

From market reports it appears that about 8*s.* per case was the average rate realised for your apples, a price which, after paying freight and other charges, will certainly not leave much, if any, profit to the producer or exporter. Considering that *good* Tasmanian apples were being retailed at the same date in England at 8*d.* per pound (about 30*s.* per case, and South Australian produce was realising 13*s.* to 15*s.* per case, there seems to be *primâ facie* evidence that some serious deficiency, arising either from bad cultivation or careless or dishonest shipment, in connection with Tasmanian exports, must have existed, which calls for examination and future immediate remedy if your fruit trade is to prosper as it should. I think you will find that the reports of your Agent-General and others interested in the matter point to the conclusion that these faults did exist, and that your producers and exporters had only reaped what they had sown, and had only themselves to blame for such a deplorable state of affairs, which must eventually lead to the loss of your English and other markets.

What such a lamentable occurrence would mean to Tasmania, the following statement, taken from figures compiled by your well-known Statistician, Mr. R. M. Johnston, will give you some idea:—

In his report the value of the fruit export for 1900 from Tasmania is estimated at about £279,988, a very considerable item in the budget of any country, but of paramount importance to a small State like yours. If the export value of other agricultural products, which is returned as being about £454,054 (including wool) be added, we have an annual total export value of £734,042, or 28·12 per cent. of the whole total export value of every description from Tasmania, and next in importance to the mineral export, valued at £1,640,778. So much for agriculture. Now let us see how forestry figures in these statistics. In a State with such important forests, containing, as I have already informed you, some of the finest timber in quality, and unique in possessing trees of dimensions and specific gravity invaluable for certain important works of construction, it might have been confidently expected that the export value of such produce would form a large asset in your revenue statistics. On examination, however, it appears that this, unfortunately, is *not* the case. In these statistics, in 1900, timber of all descriptions, including bark, only figures for export value as £71,618, but against this there is an item of import value of £23,246 for timber imported, so that this product in reality would only represent a net value of £48,372 really to the credit of your timber account.

We see, therefore, that Tasmania is importing wood from other countries, principally Norway and Sweden, a distance of about 14,000 miles, amounting to one-third of her own export of timber, and paying at least two-thirds more for it than if it were grown on her own soil. As a matter of fact, it could be grown better on your own waste lands and islands, within a few miles of your principal ports, at a mere nominal expenditure relatively to what it costs you now to import. I think you must admit that it can scarcely be called good business to go to such a distance to procure an article which you could easily have grown in your own country at a saving of 60 per cent. to 70 per cent., with the triple advantage of having sufficient for your home consumption, a large quantity for exportation to the neighbouring States (on which you could make a good profit), and last, but not least, at the same time ameliorating the hygiene of your island by plantations which would collect the rain of which you have, in some districts, so much need.

Another most regrettable fact gleaned from these statistics is that there does not appear that one single log or plank of timber had been exported in 1900 to Great Britain, the largest timber-importing country in the world, and the most important market for all other timber-producing countries in which to dispose of their produce.

Before leaving these interesting statistics, the compilation of which reflects the greatest honour on their author, I would also call your attention to that most important part of agricultural industry, dairy produce. It appears that you are exporting annually butter and cheese to the value of about £2000, and importing the same produce at a cost of about £35,000. This fact seems strange, considering that other countries, not much larger than Tasmania, are able to supply their own wants besides making the exportation of these products one of the most prosperous and remunerative of their industries.

I wish to impress upon you that the foregoing statements are not mere "idle fancies of the heated brain," but *solid facts,* corroborated by statistical figures, which, if you doubt their correctness, you can easily examine and verify for yourselves. Taking for granted, then, that these statements and figures are correct, what conclusions can we reasonably draw from them? It appears to me that we can reasonably conclude that—1st. The agricultural industry of Tasmania, particularly as regards the production and exportation of fruit, is at present not realising the advantages and profits which the resources of the country, if judiciously and properly exploited, would legitimately warrant the producers and exporters to expect; 2nd. The timber industry, considering the large area of forest lands and the quality of the wood growing there, is in a still more unsatisfactory condition as regards conservation, replanting, and exportation, while one-half of the value of exported home products is absorbed in payment of imported timber, which could and ought to be grown in Tasmania at one-third the cost; 3rd. The minor products of the farm, such as dairy produce, butter, cheese, eggs, poultry, honey, &c., may, as far as exportation is concerned, be treated as quite negligable quantities; 4th. The most strenuous efforts should be made, without delay, to determine the cause of this state of affairs, and remedies found to ameliorate the present condition and ensure the future development and prosperity of the two great industries of forestry and agriculture in Tasmania.

The causes which are generally put forward as reasons why your fruit trade is not giving a remunerative return for the labour, time, and money expended on it, are numerous. Unpropitious seasons and weather will, of course, have an influence on this as well as on other agricultural crops in every country in the world, but in such a climate as that of Tasmania it is not likely that great material injury will be caused by them, or only in rare and exceptional instances.

Pests of various kinds no doubt give sometimes much trouble, but, as a rule, their presence in numbers sufficient to menace the existence of the crop is a proof of bad or careless cultivation. During my stay in Tasmania several so-called "pest scares" arose, and it always struck me that if the same time, energy, and labour displayed in writing and disputing about their existence or non-existence, and the best means of eradicating them, in the long letters appearing every day in the newspapers, had been judiciously expended in the orchards and fruit gardens, the result would have been decidedly advantageous to the fruit crop. We must not forget that agriculture in all countries has been subject to pests of all descriptions, some of them more destructive than the average of those with which you have to deal, and Tasmania can scarcely expect to escape from the ills that plants are heir to. But scientific culture, increasing care and examination, combined with the well-directed application of the latest remedies, will be found as effective in either considerably diminishing or eradicating these pests in Tasmania, as they have been elsewhere. The suppression and extinction of pests, to be effective, must be thorough, and, consequently, entails a certain loss of fruit, as every apple affected by codlin moth, &c., or injured in any way, must be picked from the tree at once and destroyed. This waste of produce (more apparent than real, the tree profiting by the removal of unsound fruit), should be followed by careful selection, picking, and packing, if the fruit is expected to arrive at its destination in good condition. It would seem, however, that many producers are not alive to this fact, and will not take, or do not know how to take, the most necessary precautions to prevent any but the soundest and best fruit being sent to markets at a distance of some 13,000 miles. They appear to think that purchasers in England and on the Continent are such fools as to be willing to pay a good price for bad fruit, although they have the choice of importations from some of the finest fruit-exporting countries in the world. Worse still, the recurrence of inferior shipments from Tasmania will lower the reputation of its fruit, and purchasers on the other side of the world, who have neither the time nor the will to discriminate between good and bad shippers, will refuse to have anything to do with fruit exported from that country, unless at such low prices as they may think may cover any risk they run. This, in reality, means the destruction in a very brief space of time of some of the best markets in which to dispose of your produce, and the ultimate ruin of your fruit trade, now valued at the export worth of nearly £300,000.

Commercial history is full of examples, dating from the most ancient periods up to the present time, showing how some of the most flourishing trades and markets have been lost or destroyed by negligence, ignorance, or dishonest dealing, and the following extract from Mr. Neville Edwards' interesting "Story of China" shows with what disastrous results a similar policy in the once important tea trade of China has ended. "In Tea from China," he says—"The falling off in our purchases has been enormous. The Chinese have injured the reputation of their tea by re-colouring old-used tea leaves. It took a long time to knock this idea into our heads, but now having once got that idea, it will take an equally long time to regain our confidence." Substitute "Tasmania" for "China," "fruit" for "tea," and "inferior shipments" for "re-coloured tea leaves," and we have a timely warning of what may and will happen to your own fruit trade unless precautionary measures be immediately taken to prevent such a catastrophe.

In regard to your timber industry, the foregoing observations relative to the loss of a valuable market can only be applied in a limited degree, as you have not, unfortunately, as yet, got any market worthy of the name to lose. Why this should be so is a question which ought to occupy your most serious attention. It may be, and most likely is the case, that the small quantities you have exported have been of inferior quality, or not properly prepared, chosen, or suited for the work for which it was intended. Another reason, no doubt, is that no energetic means have ever been taken to bring the good qualities of your timber for construction works, paving, furniture, &c., to the knowledge of the foreign consumer, and no really business-like efforts made to establish a market for the disposal of your wood produce. Whatever the reason may be, it is more than time that a proper remedy be applied. So-called remedies have been proposed in abundance, such as—experts to examine the cases of fruit before shipment; experts to find out real, or invent imaginary, pests; experts to see that your fruit is properly packed; Agents-General to tell you that you are ruining your markets; bailiffs in your forests to prevent your destroying and burning your own property and your best timber; experts to see that the wood is of good quality, and properly seasoned and prepared before shipment, &c. Of course, as usual, it is expected that all these people are to be paid by Government, in order to prevent your wasting your money, time, and labour for no profitable result, to keep men honest against their will, and to hinder those most interested from destroying their own property, and ruining the State's prospects of success in the leading markets of the world.

All these proposals, or some of them, may perhaps be considered as a magnificent scheme of grandmotherly government and political philanthrophy, and will no doubt meet with the approbation of men who prefer others to do the work they should be doing themselves, but, to any practical and business man, such a system must appear as preposterous, as it would, on trial, prove to be useless and impracticable. What possible good can it do an agriculturist who has been properly taught, trained, and knows his business to be told by an expert that he has pests in his orchard? He ought to and would know that long before the expert, and have taken the necessary measures to abate or eradicate them, and this example applies to all the other functions to be performed by experts and bailiffs in carrying out the duties suggested in the foregoing so-called remedies. How many experts do you imagine would be required to inspect thoroughly all your orchards, fruit gardens, and agricultural establishments in Tasmania? How do you propose to inspect and examine the fruit, before shipment, on the wharves? I fear that there would not be the necessary room, and decidedly not the necessary time to do this efficiently, and better no inspection than an inefficient one. Then, where are you to get proper experts in sufficient numbers whose inspection and knowledge can be relied upon, if you have no training schools where they can study and be taught theoretically and practically their duties? In my opinion there is no real remedy for curing existing evils and preventing their continuance and recurrence in the future but one, and that is the establishment of a well-managed Tasmanian School of Forestry and Agriculture. In such an institution the rising generation, as well as adults occupied in these pursuits, would receive an education or information which would very soon render expert interference supererogatory and unnecessary. Not alone would it be of invaluable service to these two industries, but it would open a new field of enterprise and remunerative employment to the youth of Tasmania. As you are well aware, most of your professional and mercantile occupations are more than sufficiently filled up at present, and your young men are often obliged to go to other lands to seek their living, much to the detriment of your State and population, a loss which ought to be avoided, if possible.

I cannot fancy a more suitable career for your Tasmanian boys, such as I know them (active, courageous, and full of life and vigour, fond of all sports), than the fields and forests, for which such a scheme as I propose would prepare and enable them to exploit to their own advantage and to that of their country. Not only would they benefit from a material point of view, but occupied away from towns, with all their seductions and temptations, they would, in your bush, fields, and orchards, most likely become, both physically and morally, finer and better men. I wish I could impress upon parents, and particularly on the mothers and daughters of Tasmania, the importance I think they should attach to the completion of this project, and get them to use their utmost influence, so valuable and all-pervading, in a matter which concerns both their own family interests, and in which the welfare of their boys is so deeply involved, feeling certain that any successful exertions on their part to get such a school founded will eventually be amply rewarded by the results acquired.

You have also numerous agricultural, horticultural, pastoral, and other similar societies in Tasmania. I would propose that some of the most important of them should send one or more of the most promising scholars in their districts to the examinations, and, if returned successfully, pay all or part of their expenses during their education at the school. They could scarcely do anything more calculated to benefit the interests they wish to promote.

Now, supposing that such a school will, as I trust, be established, what I propose is this—Boys intended to benefit by the instruction it will afford them should, after having attained their thirteenth or fourteenth year, and completed their usual schooling term, be entered for it. An examination, one half written, one half verbal, to prove that the candidate is up to the standard in reading, writing, spelling, arithmetic, algebra, geometry, trigonometry, geography, and the first general principles of physical science, with a voluntary examination in French or German (to count as five points each, and to be added to any deficiency in English or Geometry), should be compulsory before admission. The two first examinations should, I think, be of such a nature as to allow ordinarily well educated boys from good schools to pass without much difficulty, and, as the number of pupils increase and the popularity of the school is established, the questions might be made more difficult. The maximum of points attributed to the different subjects might be distributed on a scale somewhat similar to the following:—

| *Subject.* | *Written.* | *Vocal.* | *Total.* |
|---|---|---|---|
| *English*, Grammar, Reading, Writing. &c. ... ... ... ... ... ... ... ... ... ... ... | 15 | 15 | 30 |
| *Arithmetic* and *Algebra*. ... ... ... ... ... ... | 10 | 10 | 45 |
| *Geometry* and *Trigonometry*. ... ... ... | 15 | 10 | |
| History, Ancient and Modern. ... ... ... | 5 | 5 | 25 |
| Geography, World. ... ... ... ... ... ... ... | 5 | 5 | |
| Physical Science (1st elements). ... ... | | 5 | |
| Total points ... ... ... ... ... ... | | | 100 |

In order to gain admission, the candidate would require to have gained at least one-half of the points attributed to each section.

There might be two examinations annually for the admission of pupils, at dates specified beforehand, if found necessary and practicable. The examiners would be appointed by the school authorities, one of whom should be present to superintend the proceedings. The names of the successful candidates, with the points they have acquired, as well as the establishment where they have been educated, ought to be published in the papers within a fortnight after the examination. This publicity would benefit the schools from which the successful pupils had passed, and would doubtless encourage the masters in training boys for the future examinations. After three year's study at the outside, the scholar, if attentive to his work, should be able to pass such a satisfactory final examination as will entitle him to a diploma of efficiency either in forestry or agriculture, or both, and he is fitted for a career, either in his own interests or for the account of others, who will, I feel certain, be glad to make use of his services, knowing that he is competent to render them efficiently.

Of course you will understand that I merely throw out these suggestions as my own ideas on this subject, and they ought, of course, be discussed and modified after careful study to suit the requirements of your State. I may, however, remark that, on the whole, they have proved successful elsewhere.

At one of the most prosperous of existing similar schools (I do not name it, as the information so kindly afforded me by personal friends is more or less confidential), which was founded in 1860, the progress made in the number of scholars from that date up to 1900 will be seen from the following statement:—

*Number of Scholars attending.*

| Period. | Total. | Boarders. | Day Scholars. | Native. | Strangers. | Farmers, &c. |
|---|---|---|---|---|---|---|
| 1861-1865. . . . | 167 | 112 | 55 | 110 | 57 | 10 |
| 1866-1870. . . . | 276 | 170 | 106 | 106 | 170 | 43 |
| 1871-1875. . . . | 362 | 179 | 113 | 194 | 168 | 67 |
| 1876-1880. . . . | 352 | 188 | 164 | 229 | 123 | 40 |
| 1881-1885. . . . | 392 | 234 | 158 | 305 | 87 | 35 |
| 1886-1890. . . . | 502 | 317 | 185 | 420 | 82 | 71 |
| 1891-1895. . . . | 562 | 290 | 272 | 461 | 101 | 66 |
| 1896-1900. . . . | 479 | 267 | 212 | 398 | 81 | 32 |
| 1901. . . . . | 113 | 47 | 56 | 83 | 30 | 10 |

Now this return of 40 years' progress, in cycles of five years each, is valuable and instructive as a forecast of what may happen, proportionately, to your School of Forestry and Agriculture, once it is established.

I would just call your attention to a few facts which I think may be gathered from it, and I feel certain that our good friend R. M. Johnston (who finds sermons in stones and figures in everything), can find many more if he examines the statement.

The first fact which strikes me is the small number of pupils belonging to the country in which this school is situated, who attended it during the first 10 years of its existence; viz.:—1860 to 1865, 110; and 1866 to 1870, 106; or an average of only 21 per annum. It is the confirmation of the old adage, "No man is a prophet in his own country," and which, in this case, might be freely translated "Anything got up at home is of no good." Similar remarks have, if I remember rightly, been made not 100 miles from Hobart.

The second fact is that, whereas in the first five years only 57 strangers attended, or, about 11 per annum, within the next 10 years their number was tripled. *They* were not so long in finding out the value of the school as those at home, for whom it was actually founded.

The third fact: after 10 years' hesitation, no sooner do the latter see that their own institution is certainly appreciated by strangers, if not by themselves, than they begin to think that there may after all be some good in it, with the result, that during the next five cycles their numbers are more than quadrupled.

Fourth fact: of the adult agriculturists who were permitted to attend the classes at a nominal fee (about £2 per annum), 10 only availed themselves of it in the first five years, but then their good common sense and shrewdness prevailed, and their number increased proportionately in a still greater degree.

The lessons to be derived from these facts are, I think—1st. neither to be too sanguine of immediate success, nor despondent of ultimate attainment; 2nd. Once convinced of the necessity and vital importance of the scheme, no hesitation should be allowed to interfere with its immediate commencement; 3rd. Caution and prudence in beginning, and perseverance, activity, and energy until its achievement are nearly certain to be rewarded with final success.

The school which, after serious investigation, I think to be the best model for you to follow, was at first designed to 50 boarders, but it was not until after 25 years of existence that room for this number was required. In my opinion, a house which would accommodate 12 boarders and 12 day scholars, besides manager and inside staff, would be sufficient to start with; and I think that such a house, with good outbuildings and sufficient grounds, which are so essential for the practical teaching which is such a material feature in this scheme, could be leased at a reasonable figure, and thus save the expense, trouble, and delay of building. Indeed, during my stay in Hobart, I saw some places in the neighbourhood of New Town which I thought might, with some trifling changes, prove admirably adapted for the purpose. Of course you on the spot will, particularly after you have been able to estimate the probable number of pupils likely to join at once, or in a short period, be in a better position to form an opinion of the suitability of any place better than I can do. It would be advisable, in order to induce parents or guardians to send their boys, and thus form a nucleus with which to begin operations, that the scholastic terms for pupils should be kept as low as possible. In Germany and Belgium the charge for boarders is about £40, and for day scholars £15, per annum, and, from their reports, they appear to make about £4 per year profit on each pupil. Of course it will be for those who have the management to see if it can be done for these prices, but you must remember that this school will not be founded to make money out of it, but to benefit the community and to provide for a pressing requirement if two of your most important industries are to prosper as they should. There should be a difference made between terms for Tasmanians and strangers; on the Continental plan this would mean 30 per cent. additional for boarders and day scholars. I scarcely think that, until the school begins to be known and its advantages recognised, you could count upon many strangers, but later on it is more than probable that you will get a number from the neighbouring States and New Zealand. There might also be a likelihood in these days of cheap passages, that English parents and guardians would prefer sending their boys to a lovely climate like Tasmania in preference to the Continent, provided they know they could be brought up in a suitable manner to fit them for forest and agricultural work in India, South Africa, and the Colonies, particularly as the training they would receive in Tasmania would be better adapted to prepare them for such a career.

One of the most important points to settle will be, whether the school is to be a Government one, or solely under the management of a committee chosen from the different persons most interested in the scheme. In my opinion, a combination of the two systems might prove beneficial, and give a certain status to the institution which neither, separately, would confer upon it. The Government, which will no doubt be asked, and will consent, to grant a reasonable annual subsidy at least during the first few years of its existence, will naturally and very properly claim the right of having a vote in the proceedings. The very fact of the legislative bodies having a certain control over the organisation and expenditure will have an advantageous influence as a safeguard against extravagance on the one hand, and parsimony on the other. The members of the committee will be able to bring forward a detailed scheme as practical men interested in the industries involved, knowing what is actually required and should be done.

One of the next most serious points you will have to consider will be the selection of a proper manager of the school. The importance to be attached to this can scarcely be exaggerated. Upon the choice of a competent person to occupy this position may depend, in all probability, the success or failure of the scheme. He must be a well-educated man, of a certain age and standing, to secure the respect and esteem of the parents and teachers, as well as the deference of the pupils. He must possess both energy and tact, and, indeed, he cannot have too much of each combined. He should have, if possible, a good knowledge of French and German, so as to enable him to study the very important works which appear periodically in these languages upon the management of similar schools elsewhere, and to correspond with their managers. With a practical knowledge of both forestry and agriculture, he should be imbued with a firm desire to make the school a credit to

Tasmania and to himself. It will not be an easy task to find such a man, and when found, he must be properly paid.

As for the professors or teachers, I should think four or five would be sufficient to begin with. They must be practical men, representing forestry, agriculture, fruit-growing, botany, and farm and dairy produce generally. Of course they will have to expound the theoretical reasons for the practical work taught the pupils, and which, after all, ought to be the principle part of their instruction in this school. You have among you many fit and competent for this, and you have only to make a prudent choice to secure a good working staff, and I should imagine that, wishing to further the project, they would not demand too high a payment for their services, which, with a proper division of labour, should not exceed much more than 24 hours in the week.

You will also require a capable accountant, not alone to keep the receipts and expenditure of the school, but also to teach the pupils the book-keeping so absolutely necessary for their success in their future career.

The minor details of outdoor foremen and servants must, of course, be discussed and arranged by the committee of management and the manager.

I had hoped to be able to make up for you a sort of balance sheet of " ways and means," but, on consideration, I find it would be impossible for me to do so, ignorant of the expenses you will have to incur, and, therefore, without any real basis upon which to form any reliable calculations; but this your committee will easily be able to do. I can, however, inform you that the school on the Continent, which I have chosen as a model, with about 100 pupils, has a yearly gross revenue of—

| | £ |
|---|---|
| Pupils' fees ............................ | 2120 |
| Proceeds of farm (100 acres) ......... | 800 |
| | £2920 |

and that the—

| | |
|---|---|
| Total expenditure (but not including professors' fees) is ......... ......... | £1520 |

And now comes the vital part of the whole question—How is the money necessary for the establishment and maintenance of the school until it becomes a self-supporting and paying institution to be obtained? I think we may take it as a recognised axiom in practical life and political economy, that the persons likely to profit most by the adoption and subsequent successful result of any enterprise, are those who should find the necessary resources for its establishment and support. Now, those who are sure to benefit by this school of forestry and agriculture are numerous, and can, I think, be divided into the following categories:—1st. The Government, by a larger revenue derived from extension of trade and foreign relations and sale of timber growths; 2nd. Parents of boys who will be fitted in the school for a profitable career; 3rd. Timber merchants and saw-millers; 4th. Agriculturists, fruit-growers, and exporters who, by better management and more theoretical and practical methods, will procure more remunerative returns for their produce; 5th. Small farmers, whose dairy and general farm products will reap a similar benefit; 6th. Large steamship companies, for whom the increase of fruit, timber, and other agricultural produce means better freights and larger shipments; 7th. Bankers whose clients in those industries will be doing a more lucrative and safe business; 8th. The whole community, who must profit by the success of these industries.

Now, let us see what these different sections ought reasonably to contribute to securing the success of this scheme—

| | | £ |
|---|---|---|
| 1st. | The Government annual subsidy ...... | 250 |
| 2nd. | Parents, pupils' fees........................ | 660 |
| 3rd. | Timber merchants and saw-millers ½ per cent. on export value of wood, say £50,000 (or an equivalent per 100 s. ft.)............................... | 250 |
| | (To be augmented as trade increases.) | |
| 4th. | Agriculturists and fruit growers and exporters, ¼ per cent. on £733,000 export value (or equivalent per case, sack, or bale) ............................. | 1830 |
| 5th. | 100 small farmers, at £2 .................. | 200 |
| 6th. | Five steamship companies, at, per annum, £20 each .... .. .. .... .... | 100 |
| 7th. | Three banks, at, per annum, £20 each | 60 |
| 8th. | Subscriptions from agricultural Societies and private individuals ......... | 200 |
| | Making a total of ......... | £3550 |

Now, this will give you an idea of what a really infinitesimal tax on all who are likely to profit by the project under discussion would place annually at the disposal of the managing committee. Of course, the figures can be changed or modified to suit the requirements and circumstances of the case, but I do not think that any real objection can be made to such a reasonable solution of finding the funds required for the purpose.

I have not the honour of knowing personally your new Governor, but from all reports he is a thoroughly energetic and shrewd business man. If you can only convince him of the necessity and value of such an institution, and enlist his sympathy and co-operation in your efforts, I think success is certain. I am persuaded that the foundation and ultimate success of such a school, under his auspices, will add fresh laurels to his diplomatic career.

In conclusion, I have done my utmost to impress the importance of this subject upon you. I only wish I could be with you to aid by advice and assistance, but, as I have already told you, my services are always at your disposal to carry out a project which I feel sure will benefit Tasmania, to which I am so sincerely attached, and where I received such kindness and made so many new, and, I trust. lasting friendships.

# EVIDENCE OF GRAPTOLITES IN TASMANIA.

*By* T. S. HALL, M.A. (Melbourne University, Corr. Memb.)

Read 29th April, 1902.

At the last Sydney meeting of the Australasian Association I discussed the Tasmanian graptolite record,* and arrived at two conclusions—Firstly, that Thureau had found a Diplograptus, and, secondly, that, on the supposed identification of an (Upper) Silurian graptolite, the Lisle slates had been referred to Ordovician.

After the publication of my paper Mr. Thureau wrote to me on the matter. He speaks of the Lisle so-called graptolite, that is, the one he had recorded under the useless name of Diplograptus nodosus, as follows:—"I now recollect seeing there (*i.e.*, at Lisle, T.S.H.) dark elongated imprints—probably carbonaceous—in those dark-blue slates, but they were too indistinct to be classified. . . ." Then follow some remarks which explain the confusion into which I fell in my previous paper through my ignorance of Tasmanian geography. "With regard to the *true* graptolite . . the locality is about 10 miles from Strahan, on the old Mount Lyell Road (Tas.), close to an old road-maker's camp and stable, near a spring of water." This is the specimen which, from Mr. Thureau's conversation, I felt convinced was a Diplograptus. Of the Lisle record I express no other opinion than my belief in its worthlessness.

During the session of the Australasian Association, at Hobart, last January, while looking over some samples of slate in the collection of Mr. Thomas Stephens, M.A., I found traces of a graptolite in a specimen from near the Ring River, on the North-East Dundas Railway. I understand that the rock samples had been given to Mr. Stephens by Mr. G. A. Waller, Assistant Government Geologist. The slate is a very hard, much-jointed rock, with a silky lustre, and the fossil is badly preserved. Some branched talcose and ferruginous markings first caught my eye, and on examination with a lens I found three or four thecae.

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* 1 Rep. Aust. Ass. Adv. Sci., v. 7, 1898, p. 401.

As the thecae can be seen only when the specimen is held in a particular position with regard to the light, they are not easily demonstrated. Their outer edge is straight, and the apertural margin is about normal to the branch. From the appearance of the indistinct markings present on the stone the specimen belongs to the Dendroidea, and I am inclined to think to the genus Callograptus, which is in itself of no great stratigraphical value.

A few weeks ago Mr. Waller sent me two slabs of slate from 12½ miles from Zeehan, on the same railway line. On one of these a fragment showing graptolite thecae can be distinguished, the specimen being monoprionidian. The specimen on the other slab is more obscure, and I can only say it is suggestive of a graptolite. In neither instance can even a guess at the family be hazarded.

We thus have undoubted evidence of the existence of graptolites in Tasmania, but, so far, no evidence is thrown on the exact age of the containing rocks, and it rests with those on the spot to fill up the hiatus in our knowledge.

Mr. Stephens' specimen has been sent to the Hobart Museum, and Mr. Waller's two specimens to Mr. Twelvetrees, for the Survey Collection.

# NOTES ON UNRECORDED AND OTHER MINERALS OCCURRING IN TASMANIA.

*By* W. F. PETTERD.

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THE following notes, in conjunction with a paper upon the subject published in the proceedings of the Royal Society of Tasmania, 1897, embrace the work done to elucidate the mineralogy of the State since the publication of the "Minerals of Tasmania, 1896."

They comprise many interesting substances of more recent discovery, including one, or perhaps two, which are quite new to mineralogical science. It will be found that 40 species hitherto unknown as occurring in this Island have been added to the already voluminous catalogue, and additional localities and associations are recorded for several previously known. An important feature is the record of several complete analyses of complex substances, for which I am indebted to Mr. S. Pascoe, of the Magnet Silver Mining Company, and Mr. O. E. White, of Hobart, to whom I return my sincere thanks for their ready and valuable assistance. Such work is invariably a welcome addition to mineralogical investigation, and I am sure it will be duly appreciated by those interested in this field of enquiry. In many cases it is only by such means, coupled with crystallographic characters, that the specific identity can be attained with reasonable certainty. It is almost needless to say that in this department much yet remains to be done before we can possess a comprehensive knowledge of the minerals known to occur in this State.

1 ANALCITE.—(*Hydrous silicate of sodium and aluminium.*)

Somewhat abundant in the haüyne phonolite of Port Cygnet.

2 ANORTHOCLASE.—(*Triclinic soda-potash-felspar.*)

In rhombic sections of a shining milky-white. Sölvsbergites of Port Cygnet.

3 **ARSENOPYRITE.**—(*Sulph-arsenide of iron.*)

In peculiar minute crystal trillings implanted in cavities in hard gossan. Magnet Mine.

As minute needles abundantly scattered throughout siderite gangue. Block 291, Ringville.

*Analysis of this Mineral.*

Fe = 32·95,
As = 43·20,
S = 21·48,

97·63,

with about 2 per cent. of antimony.

4 **AUGITE.**—(*Variety of pyroxene.*)

The embedded crystals of the nephelinite of the Shannon Tier are of a shining black colour, and often of remarkably large dimensions, sometimes one inch and a half in length.

5 **BERESOWITE.**—(*Chromate and carbonate of lead.*)

Occurs as small, in many cases almost microscopic, lamellæ implanted in gossan. The colour varies from pale yellow to orange-red. It is sometimes changed to crocoisite. Magnet Mine.

6 **BERYL.**—(*Metasilicate of beryllium and aluminium.*)

At the Shepherd and Murphy Mine, Bell Mount, specimens have occurred several inches in length, wholly changed to gilbertite, fluor, and chlorite. At the same locality small slender crystals have been met with of a pale green colour, intermixed with quartz, topaz, molybdenite, and cassiterite. The crystals are commonly embedded in a thin film of pyrite.

7 **BOURNONITE.**—(*Sulphantimonite of lead and copper.*)

In bright well-developed orthorhombic crystals, which gave the following result upon analysis:—

S = 13·62 per cent.
Sb = 28·68 „
Pb = 42·39 „
Cu = 11·93 „
Fe = 1·97 „

98·40

8 **BRUCITE.**—(*Magnesium hydrate.*)
Radiating, massive, and white, near the workings, Mt. Bischoff.

9 **CALCITE.**—(*Carbonate of calcium.*)
Some remarkably fine crystals have been obtained at the Mt. Lyell limestone flux quarry at Queenstown. (H. W. Judd.)

10 **CAMPYLITE.**—(*Lead arsenate.*)
In very characteristic barrel-shaped crystals aggregated together. The colour is very pale, almost white. Britannia Mine, Zeehan.

11 **CARMINITE.**—(*Arsenate of lead and iron.*)
In minute orthorhombic groups of crystals coating fractures and vughs in gossan. It is of a reddish colour, and adamantine lustre. The Magnet Silver Mine.

12 **CASSITERITE.**—(*Dioxide of tin.*)
Pseudomorphous after orthoclase. Mt. Rex Mine, Ben Lomond.

13 **CERUSSITE.**—(*Carbonate of lead.*)
Analysis of the characteristic form of a yellowish-green colour from the Adelaide Proprietary Mine, Dundas, by Mr. J. C. H. Mingaye, F.C.S., of Sydney, N.S.W.:—

$PbO$ = 83·07 per cent.
$CO_2$ = 15·97 „
$Cr_2O_2$ minute trace.
Gangue ·62 per cent.

99·66

14 **CHALCOPHANITE.**—(*Hydrated manganese and zinc protoxide.*)
As an amorphous black metallic brilliant substance, somewhat rare. Dundas.

15 **CHALCOCITE.**—(*Copper sulphide.*)
Occurs massive in several of the Mt. Lyell mines and at the King Jukes Mine, Mt. Jukes. Small crystals have been obtained disseminated in schist, with bornite, at the North Lyell Mine.

In slugs up to many pounds in weight, associated with native copper, at the King Lyell Mine. (H. W. Judd.)

**16** Clinochlore.—(*Basic magnesium and aluminium silicate.*)

In large masses and occasionally crystalline bunches of a pale metallic green colour. Near Mt. Heemskirk.

Abundant in fine groups of hexagonal crystals of a dark olive-green to black colour. The plates are often over one inch in diameter. Near the Hampshire Hills Silver Mine, Hampshire Hills.

At Anderson's Creek in minute, almost microscopic, radiating bunches of a dark colour. (W. H. Twelvetrees.)

**17** Chlorite.—(*Basic silicate of magnesium and aluminium.*)

In schist, and as beautiful bright green fan-shaped crystals in honey-combed quartz—Crown Lyell Mine—species undetermined. (H. W. Judd.)

Occurs pseudomorphous after felspar—Block 4891-93m, Ben Lomond. (Waller, "Report on the Ben Lomond District," 1901.)

**18** Copiapite.—(*Hydrous basic ferric sulphate.*)

Results from the decomposition of pyrites, Colebrook Mine, Ringville, Khaki Mine, Whyte River, and at Barn Bluff. The rock from the last-named locality, when freshly broken out, soon becomes coated with this and other sulphates.

**19** Crocoisite.—(*Chromate of lead.*)

Rare as small crystals in gossan at the Silver Queen Mine and at the Colonel North Mine, Zeehan. (H. W. Judd.)

A full detailed description of the typical and well-known Dundas occurrence of this beautiful mineral, by C. Palache, may be found in the "American Journal of Science" for 1896, page 389.

**20 Deweylite.**—(*Hydrous basic magnesium silicate.*)

In thin seams, sometimes reaching a foot in width, traversing serpentine. Harman's Rivulet, near the Parson's Hood Mountain.

**21 Dolomite.**—(*Carbonate of calcium and magnesium.*)

Analysis of the pure white form from the Magnet Mine. (F. O. Hill.)

$CaO$ 31·72 per cent. = $CaCo_3$ 56·64 per cent.
$MgO$ 15·60 „ = $MgCo_3$ 32·76 „
$Fe$ 3·92 „ = $FeCo_3$ 8·26 „
$Mn$ 1·80 „ = $MnCo_3$ 3·76 „
101·42

**22 Dundasite.**—(*Hydrous carbonate of lead and aluminium.*)

"Minerals of Tasmania," 1896, page 33.

Dana, "First Appendix to the Sixth Edition of the System of Mineralogy," page 23.

The following is a complete analysis of this new species:—

$Pb$ = 38·84 per cent = $PbO$ 41·86
$Al_2O_3$ 26·06
$Fe$ = 3·85 „ = $Fe_2O_3$ 5·50
$H_2O + Co_2$ 28·08
101·50

Mr. Pascoe states that the $Fe_3$ and $O_3$, or a portion thereof, may be foreign to the substance, as it is next to impossible to perfectly separate it, since it almost invariably occurs as an incrustation on the mineral from the original locality at Dundas. A trace of $P_3O_3$ was also found; this was certainly obtained from an extremely thin coating or skin of pyromorphite, which is often present, and gives an external green colouration to the surface of the mineral. At the Hercules Mine, Mt. Read, a mass of snow-white cellular quartz has been obtained, throughout which are scattered crystals of cerussite, gibbsite, and numerous patches of dundasite, the whole forming one of the most attractive associations of minerals as yet obtained in this State.

**23** Dufreynoysite.—(*Sulpharsenite of lead.*)
Analysis:—

Pb = 32·88
Cu = 9·08
As = 21·60
Sb = 8·53
Fe = 6·42
S = 21·79
Ag = 0·22 = 73 ozs. 3 dwts. 11 grs. per ton.

100·52

Occurs in thick orthorhombic crystals, which are deeply grooved longitudinally, colour lead-grey, highly polished, and implanted on and in the cavities of crystalline siderite. Many of the beautifully developed crystals exceeded 1'' in length and $\frac{3}{8}$'' in width. Locality, Block 291, North-East Dundas.

**24** Elæolite.—(*Orthosilicate of sodium, potassium, and aluminium.*)

Occurs as a constituent in the elæolite syenite of Port Cygnet.

**25** Epidote.—(*Basic silicate of calcium, aluminium, and iron.*)

Occurs very well crystallised and of good colour on the Melba Flat, North Dundas. (H. W. Judd.)

**26** Evansite.—(*Basic phosphate of aluminium.*)

Analysis of this mineral from Zeehan, by Mr. H. G. Smith. (Proceedings Royal Soc., N.S.W., 1895.)

$P_2O_5 = 18·11$
$Al_2O_3 = 40·19$
$H_2O = 41·27$

99·57

**27** Gilbertite.—(*Variety of potassium mica.*)

Of a yellow to green colour and glimmering lustre with tin ore in granite. Mt. Rex Mine, Ben Lomond, Anchor, Liberator, and other mines, Lottah.

**28** GIBBSITE.—(*Hydrate of aluminium.*)

Apparently abundant in botryoidal masses, associated with native copper and earthy lode-material. It varies in colour from clear pellucid glassy to pale green, and more rarely to golden yellow with a bronze lustre. It decomposes to a white powder. Rio Tinto Mine, Savage River.

**29** GMELINITE.—(*Hydrous sodium, calcium, and aluminium silicate.*)

A fine lot of perfect crystals of this zeolite have been obtained loose and coating a vugh in Tertiary basalt at Bell Mount. Middlesex.

**30** HAÜYNITE.—(*Sodium, calcium, and aluminium orthosilicate with sodium sulphate.*)

In micro-crystals sparingly in the fayalite-melilite basalt from One Tree Point, near Hobart.

**31** HEMATITE.—(*Sesquioxide of iron.*)

At Zeehan this occurs pseudomorphous after cubical pyrites. (R. F. Waller.)

**32** HISTRIXITE.—(*Sulphide of antimony and bismuth.*)

An apparently new substance occurring in radiating groups of prismatic crystals, which are occasionally in confused bunches, and commonly stained externally with a dark brown coating. The crystals are orthorhombic, with acute but indistinct terminations, and striated longitudinally. They sometimes reach over 2 in. in length by ⅜ in. in width. Slightly sectile, with a hardness of about 2. Lustre eminently metallic, shining on fresh crystalline surfaces. Colour and streak, steel-grey. When massive, it presents a foliated structure, and tarnishes to blue and purple iridescent colouration. The crystals occurred interpenetrating a vugh from a bedding of a mixture of iron and copper pyrites. It was found in a somewhat massive body of tetrahedrite, with which were associated bismuthinite and pyrites, and appeared to be of very exceptional occurrence.

Result of two analyses of the pure material:—

S = 24·05 S = 23·01
Bi = 55·93 Bi = 56·08
Sb = 10·08 Sb = 9·33
Cu = 6·86 Cu = 6·12
Fe = 5·18 Fe = 5·44
102·10 99·98

Answering to the formula—

$7 Bi_2 S_3 + 2 Sb_2 S_3 + 5 Cu Fe S_2$

(Locality, No. 1 Curtin-Davis Mine, Ringville.)

**33** HUASCOLITE.—(*Sulphide of lead and zinc.*)

A massive, fine-grained, dark-coloured and somewhat dull substance—Comstock Mine. Zeehan.

**34** HYDROMAGNESITE.—(*Basic carbonate of magnesium.*)

Occurs in solid, almost white, radiating bunches—Comstock Mine. Zeehan.

**35** HYPERSTHENE.—(*Magnesium and iron metasilicate.*)

In basalt, Circular Head; in granite, St. Mary's Pass.

**36** JAMIESONITE.—(*Sulphantimonite of lead.*)

Analysis of a sample from the Magnet Mine:—

Ag = 0·12 per cent. = 39 ozs. 4 dwts. 10 grs. per ton.
Pb = 40·82
As = 2·44
Sb = 21·48
Fe = 4·91
S = 17·51
Insol = 11·51
98·85

Analysis of a sample from the Silver Spray Mine, Zeehan, by W. F. Ward, Government Analyst:—

Pb = 40
Sb = 29
S = 18
87

Analysis of a columnar and striated sample from Mt. Bischoff:—

Ag = 0·12
Pb = 32·08
As = trace
Sb = 26·74
Fe = 5·56
S = 17·82
$SiO_2$ = 14·28
Al = trace

96·60

**37** JOHNSTONOTITE.—(*A new manganese garnel. Pro. Roy. Soc., Tas., 1898-99.*)

Occurs abundantly distributed in the mica-sölvsbergite of Port Cygnet. The cavities containing the garnet are often lined with a thin coating of purple fluor and arsenical pyrites.

**38** KNOXVILLITE.—(*Hydrous basic sulphate of chromium, iron, and aluminium.*)

Occurs as a granular sugar-like substance of a pale green colour. From adit at the Victoria Gold Mine, Salisbury.

Analysis:—

$SO_3$ = 30·32 per cent.
$Cr_2O_3$ = 8·47 „
$Al_2O_3$ = 2·48 „
$Fe_2O_3$ = 15·86 „
Loss on ignition 40·56 „

97·59

The identification is somewhat doubtful. Associated with this sulphate is another of a fibrous habit. It has been found in large compact felted masses, which are extremely tough under the hammer, and comparatively heavy from contained hygroscopic water. The fibres are minute, short, and silky-white; the surface often nodular and rough from protruding fine spiculæ.

An analysis of this substance gave the following result:—

| | |
|---|---|
| $SO_3$ | = 27·20 |
| $Fe_2O_3$ | = 14·0 |
| $Cr_2O_3$ | = 10·64 |
| Loss on ignition over | 39·19 |
| Gangue | 10·77 |
| | 101·80 |

Before the blow-pipe the substance swells and forms a brown-coloured mass, which is easily powdered. With soda, after trituration, it leaves a loose powdery residuum, which is readily attracted by the magnet. The fused mass with borax bead gives reactions of iron and chrome oxides. It is readily soluble in water, and if kept in dry situation it gives up much of its hygroscopic moisture. If a new mineral species, which is highly probable, I propose it should be called "Sclerospathite."

**39** Leuchtenbergite.—(*A variety of chlorite poor in iron.*)
In the variolite rock at the Magnet Mine.

**40** Lillianite.—(*Sulphobismutite of lead.*)
Found disseminated in association with bismuth, sulphide, and other minerals in a quartz matrix at the Osborn Blocks. Mt. Farrell.

**41** Magnetite.—(*Sesquioxide and protoxide of iron.*)
In bunches of well-formed crystals—Tenth Legion Mine, Zeehan. (H. Waller.)

**42** Margarite.—(*Basic aluminium and calcium silicate.*)
In irregular radiating bunches in schist. Locality, west slope of Hamilton Hill, near the Hercules Mine.

**43** Melilite.—(*Complex silicate.*)
As microscopic rock-forming crystals in the melilite basalt of the Shannon Tier and One Tree Point, near Hobart.

**44** Microcline.—(*Triclinic potash soda felspar.*)
Occurs abundantly in the hypersthene granite of St. Mary's Pass.

**45** MILLERITE.—(*Sulphide of nickel.*)
In the characteristic capillary patches in quartz, with pentlandite—near the Colebrook Mine. Ringville.

**46** MONAZITE.—(*Phosphate of cerium metals.*)
This mineral has been obtained in a fine granular form in alluvial at the following localities, in addition to those quoted in the "Minerals of Tasmania":—Stanley River, South Esk Tin Mine (Ben Lomond), Briseis Tin Mine (Derby), the Pioneer Tin Mine (Mt. Stronach), and at the Khaki Mine at the foot of the Meredith Range).

**47** NATROLITE.—(*Hydrous sodium and aluminium silicate.*)
Somewhat abundant in massive pure white masses and pockets, which often exhibit distinct rhombic crystals agglutinated together. Nephelinite, Shannon Tier.

**48** NEPHELITE.—(*Orthosilicate of sodium, potassium, and aluminium.*)
In microscopic crystals, as an essential constituent in the nephelinite of the Shannon River.

**49** NONTRONITE.—(*Hydrated iron silicate.*)
A green variety of chloropal. Occurs of a pale yellow-green colour. Middlesex.

**50** OSMIRIDIUM.—(*Iridium and osmium in varying proportions.*)
A fine nugget of this substance was recently obtained in the Whyte River, near its junction with the Pieman. The specific gravity was 19·5, and weight 60 grains.

**51** PECTOLITE.—(*Metasilicate of sodium and calcite.*)
Occurs in fibrous radiating bunches of a pure white silky subvitreous lustre—Upper Emu River. W. R. Bell.

**52** PENNINITE.—(*Basic silicate of magnesium, aluminium, and iron.*)
In dark, almost olive-green, masses and crystals, the latter sometimes over $\frac{3}{4}''$ across. It is invariably associated with quartz—Tharsis Copper Mine. Mt. Lyell.

**53** **Perofskite.**—(*Titanite of calcium.*)
Microscopical crystals in the melilite basalt of the Shannon Tier.

**54** **Petterdite.**—(*A new oxychloride of lead. Pro. Royal Soc., Tas., 1901.*)
Occurs implanted and in bunches of pseudo-hexagonal crystals—Britannia Mine. Zeehan.

**55** **Pharmacosiderite.**—(*Hydrous basic iron arsenate.*)
Found as coatings of microscopic cubic crystals of an intensely green colour and bright lustre—Magnet Mine. (R. F. Waller.)

**56** **Phosgenite.**—(*Chlorocarbonate of lead.*)
Some fine adamantine crystals of this somewhat rare mineral have been obtained at the Comet Mine, Dundas, with anglesite and cerussite.

**57** **Picotite.**—(*Aluminate of magnesium and chrome.*)
Chrome spinel is stated to occur in the vicinity of Zeehan. (Krausé, "Mineralogy," p. 245.) Abundant in the alluvial of the Heazlewood River.

**58** **Prosopite.**—(*Hydrous fluoride of aluminium and calcium.*)
Occurs as a granular powder, and often kaolinised. It is associated with decomposed green tourmaline (zeuxite), which is so characteristic of Mt. Bischoff Tin Mine.

**59** **Rhodonite.**—(*Metasilicate of manganese.*)
Massive, in a somewhat impure form as a boulder in a large asbestos seam in serpentine on the ground leased to the Australasian Asbestos Company at Anderson's Creek, west of Beaconsfield. Called "red quartz" by the miners. (W. H. Twelvetrees.)

**60** **Saponite.**—(*Hydrous magnesium and aluminium silicate.*)
Occurs in patches of a yellow to brown colour and glimmering lustre, with chrome ochre and quartz on the hanging-wall of a reef at the Duchess of York Mine, Salisbury.
White and amorphous at Trial Harbour. West Coast.

**61** Scapolite.—(*Hydrous silicate of aluminium and calcium.*)

This mineral was found as loosened rounded boulders in a seam of asbestos occurring in the serpentine at Anderson's Creek, near Beaconsfield. It was mistaken by the miners for quartz, which it somewhat resembles. It has, however, a slightly greenish tinge, and its hardness is only between 5 and 6. It is soluble with difficulty in HCl.

*Microscopical characters.*—Confusedly crystalline, with the larger crystal faces obscurely divergent. The crystals often form rosettes. Double refraction, strong; interference colours higher than quartz; extinction straight in longitudinal sections; no sensible absorption.

Scapolite is mostly found in schists and gneiss. It also occurs in amphibolites and ophites. When it is found in gabbro, it has been derived from felspar, and this may have been the case here, though there is some reason to believe that the serpentine was originally pyroxenite. Scapolite is undeniably a secondary mineral, and was here formed during the hydro-metamorphic process of serpentinisation. (W. H. Twelvetrees.)

**62** Scheelite.—(*Tungstate of calcium.*)

Analysis of a sample of this mineral from Mt. Ramsay:—

$W\,O_2$ = 79·77
$M\,O_3$ = trace
$Ca\,O$ = 19 65
99·42

(Dana, "System of Mineralogy," page 987.)

**63** Schrötterite.—(*Hydrous aluminium silicate.*)

A soft brittle white to honey-yellow coloured gum-like substance, occurring as an incrustation and in patches in a fissure in Silurian slate. It decomposes to a white powder. Occasionally it is stalactitic or mamillated, and easily falls to pieces. Obtained near the Pieman River.

**64** SIEGENITE.—(*Sulphide of cobalt and nickel.*)
Occurs massive, of a steel-grey colour, intermixed with magnetite, pyrite, and niccolite. Rocky River Mine.

**65** SODALITE.—(*Chloro-silicate of sodium and aluminium.*)
In the elæolite syenite of Port Cygnet, changed to natrolite.

**66** SPODUMENE.—(*Aluminium and lithium metasilicate.*)
Variety, *triphane.*
Several thin flakes of this substance have been obtained in alluvial tin workings near Mt. Cameron, with quartz, topaz, and sapphire. It is of the very characteristic yellow-green colour, and quite indistinguishable from the clear samples found in Brazil. It might easily be mistaken for a variety of corundum—Oriental topaz—or even quartz; in fact, it is highly probable that it is more abundant than supposed, but has been overlooked from its resemblance to the minerals mentioned. Some minute bright green specks in granite from Ringarooma are probably the same mineral.

**67** STILBITE.—(*Hydrous sodium, calcium, and aluminium silicate.*)
In large radiating masses of a yellow-brown colour imbedded in basalt vitrophyre. Bell Mount, Middlesex.

**68** STRIGOVITE.—(*A basic silicate of iron and aluminium.*)
A chlorite-like mineral consisting of a black shining aggregate of minute plates, in the fractures decomposed to brown. Occurs as a narrow band a few inches wide in granite—near the Great Republic Tin Mine. Ben Lomond.

**69** STROMEYERITE.—(*Sulphide of copper and silver.*)
Analysis of an amorphous slug from the Mt. Lyell Mine:—

Ag = 13·80 = 4507 ozs. 19 dwts. 23 grs. per ton
Pb = 1·60
Cu = 32·46
As = 3·17
Sb = trace
Fe = 19·26
S = 38·27
———
98·66

**70** SULPHUR.—(*Native.*)

Found in minute blebs on crystallised and other galenite. Magnet Mine.

**71** SYMPLESITE.—(*Hydrous iron arsenate.*)

Occurs thickly coating gossan in small radiating blue-green tufts, of great attractiveness under the lens. Magnet Mine.

**72** TENNANTITE.—(*Sulpharsenite of copper.*)

Analysis of a sample from No. 4 adit, Mt. Lyell Mine:—

Ag = 0·54
Cu = 16·17
As = 13·82
Sb = 17·10
Fe = 16·39
S = 30·77

94·79

**73** TEPHROITE.—(*Orthosilicate of manganese.*)

Occurs in crystallised masses of a dark reddish-brown colour and greasy lustre. Blyth River.

**74** TETRAHEDRITE.—(*Sulphantimonite of copper.*)

Variety, *Freibergite.*

Analysis of a pure sample from the Hercules Mine, Mt. Read:—

Ag = 9·82 per cent. = 3201·32 ozs. per ton.
Au = ·0019 „ = 13 dwts „
Cu = 29·76
As = 2·69
Fe = 4·56
S = 27·21

94·7319

Balance, insoluble matter.

Occurs in well developed crystals at the 650-ft. level, Western Mine, Zeehan.

**75** THOMSONITE.—(*Hydrous sodium-calcium-aluminium silicate.*)

In bunches of white capillary fibres coating vughs in the nephelinite of the Shannon Tier.

**76** VARISCITE.—(*Hydrous phosphate of aluminium.*)

As incrustations, often with a uniform surface. General character somewhat dull, but of a bright emerald-green colour, and thus sometimes mistaken for an ore of copper.

Associated with wavellite. Back Creek.

Implanted in the cleavages of quartz. Lefroy.

**77** VOLTZITE.—(*Oxysulphide of zinc.*)

Formed as an incrustation of a thin lamellar structure and globular; colour, clove-brown. Very Rare. Silver Crown Mine, Zeehan.

**78** WAVELLITE.—(*Hydrous basic phosphate of aluminium.*)

Occurs in small white discs, with the characteristic radiating structure implanted in the cleavages of sandstone. Ballast Quarry, Zeehan—Comstock Line.

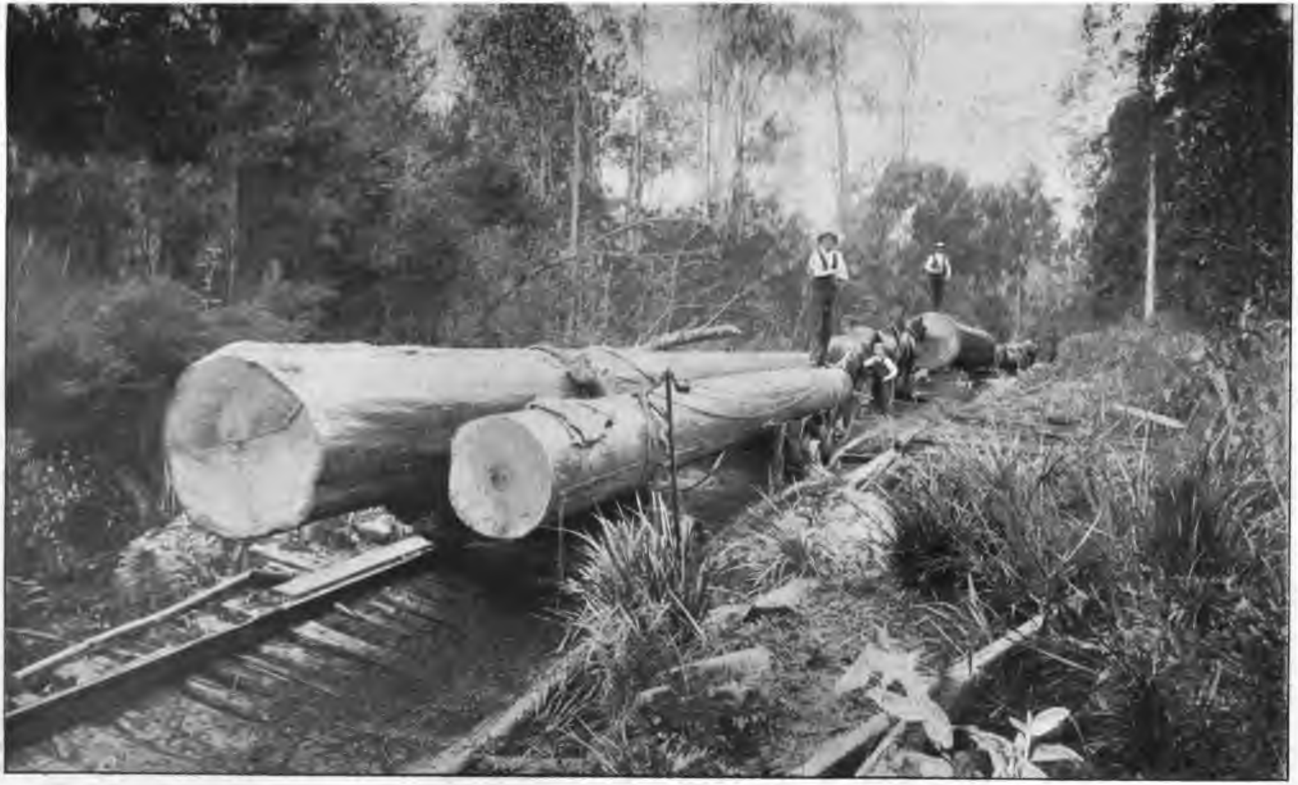
**79** WOLFRAM.—(*Tungstate of iron and manganese.*)

An unusual occurrence of this mineral is in small patches, associated with stannite and pyrite, at the Oonah Mine. Zeehan.

Occurs in the form of small brown crystals in quartz. Mt. Bischoff Mine.

**80** ZEUXITE.—(*A ferriferous tourmaline.*)

A peculiar variety of tourmaline of a dark green colour, of remarkable habit. It is confined to and characteristic of the tin-deposits of Mt. Bischoff, where it occurs in great abundance, often forming rock masses of considerable size. Its common habit is in short acicular crystals, which are interlaced together into irregular bunches. Both colour and habit are very constant.



SAWMILL TRAMWAY.

# THE TIMBER INDUSTRY.

*By* A. O. GREEN.

Read 12th August, 1902.

## FOREST PRODUCTS.

AMONG many other natural resources, Tasmania possesses large forests of valuable timbers. It is a land of forests, extending in many places to the water's edge, and producing more than 50 varieties of timber trees, from which woods suitable for almost any purpose may be obtained. There is no lighter Pine than the Tasmanian King William, and none more durable than the Huon Pine. Tasmanian Horizontal is almost the toughest wood in the world; while the Native Ironwood resembles *Lignum Vitæ* in weight and hardness, and is used for pulley-wheels and plummer-blocks. The Tasmanian Beech (locally known as Myrtle) is as strong as English Ash, and in character resembles the hardest and heaviest English Beech. The Native Box and Whitewood are suitable for engraving blocks and fine turnery, and there are more than a dozen species of Tasmanian trees adapted for ornamental and decorative purposes. One of the most beautiful ornamental timbers, the Blackwood (*Acacia melanoxylon*)—often used in the outlying districts for making post and rail fences—has for many years past been extensively used in Melbourne for the manufacture of billiard-tables, and within the last few years by well-known London firms for pianos. Some of it is called locally "fiddle-back," from the resemblance of its grain to that of the back of a fiddle. It is of a rich reddish brown to an almost black colour, banded with golden-brown. The Huon Pine, from which large panels up to three feet in width can be cut, the grain of which is curiously curled and spotted, like the "bird's-eye" Maple, is of a light yellow colour, turning browner with age. Some Red Myrtle trees also produce good figured-timber. The Myrtle is also subject to a growth which produces large bosses on the trunk two or three feet across and a foot thick, which are prized for veneers and ornamental work. The boles of the Musk, the wood of which is of a yellowish brown colour, and takes a very high finish, have a great reputation for furniture-wood. There are also a number of the smaller trees, from which pretty wood can be obtained for inlaying and the smaller kinds of ornamental work. These are all used locally, and are highly esteemed, but are not to be found in such quantities as to form the basis of a trade by themselves. Tasmania has a great wealth of ornamental wood besides these, which is at present almost entirely neglected. The various Gum trees grow with a straight, clean barrel to an immense height, and above six to ten feet from the ground the trunks have a very small amount of taper, but from two feet below the ground to this height there are curving buttresses springing from the roots which all unite to form the trunk of the tree. This part of the wood is so hard to chop that trees are never felled less than three feet from the ground, and often scaffolds are erected to enable the woodman to cut the tree through at a point from six to twelve feet above the ground. These stumps are left as they stand, and often contain the most beautiful wood, from a yellow to a bistre brown colour, crinkled and waved and barred, the grain of which, when polished, has a singularly bright appearance. Very occasionally such stumps of trees are got up, and are reduced to panels for wardrobes and drawer-fronts, but as a rule they are entirely neglected, and left to decay where they grew. This ornamental wood, if systematically put upon the market, would be valuable, as it can be supplied in quantity, and natural curves very suitable for furniture-making can be got.

In Tasmania the forest lands may be classed as "bush" and "forest." In the Tasmanian "bush" the timber trees are comparatively small, and the undergrowth appears either in patches or, if continuous, is so stunted that little difficulty is experienced in walking through it. In the forests the reverse is the case. The soil may be of the richest or poorest description, but, thanks to the humid atmosphere, due to the proximity of the sea in every direction, and the fact that the mountain peaks of Tasmania draw down the rain-clouds sweeping up from the Southern Ocean, the prodigality of growth is equalled only in tropical regions. In many cases not a foot of soil can be seen, so dense is this wealth of foliage. The ground is covered with cat-head fern (*Aspidium aculeatum*) from one to two feet in height, or with "lady" fern (*Pteris incisa*) rising to three or four feet. Above these rise the "tree" ferns (*Dicksonia antarctica* and *Alsophila australis*), growing from four to eighteen feet in height. Above these rise the smaller trees locally termed "scrub," though their height ranges from ten to forty feet or more, their diameter being from three to twelve inches—the Musk (*Olearia argophylla*), Dogwood (*Pomaderris apetala*), Wooden Pear (*Hakea acicularis*), Sassafras (*Atherosperma moschata*), and several minor species, some of them flowering shrubs. Above all this wealth of foliage rise the timber trees, straight in grain, because they have to struggle upwards to the sunlight (which rarely falls on the lower growth of ferns), and branchless until they have far overtopped the scrub below them. These forest giants are confined to the *Eucalypti*, or "Hardwoods," of Tasmania, the Myrtle, though it attains a large girth, not being so lofty.

The principal agricultural districts in this State have been "carved" out of the primeval forest. To the agricultural settler the timber, so valuable elsewhere, is (except such as he requires for buildings, fences, &c.), the bane of his existence, and his whole energy is devoted to destroying it with axe and fire. Fortunately for the timber, the inhabitants have so far been too few to appreciably diminish the immense extent of forest with which the Island is covered. Tasmania has until of recent years been far from a market, but the knitting together of the countries of the world by improved steam communication, and the increased scarcity of timber in the older countries, make it apparent that there is an opening for the profitable employment of capital and energy in rendering marketable the various vegetable products of this State. There is a steady trade with the other Australian States and New Zealand, and timber is also sent to South Africa, to England, and the Continent of Europe. Tasmanian Eucalyptus oil is sent all over the world, but as yet the trade is very small compared with what it might be, and several industries are quite untouched. Pyroligneous acid and potash might be made, also wood-pulp, besides which the distillation of essential oils could be largely increased. One common tree, the Native Box (*Bursaria spinosa*), of the order *Pittosporiæ*, is impregnated with a very fragrant resin, while the Oyster Bay Pine (*Frenela rhomboidea*) exhudes gum sandarach, and the grass-tree (*Xanthorrœa*), a red resin which is used as dragon's-blood for staining and for making varnish. The Tea-trees (*Melaleuca* and *Leptospermum*) and other trees have very fragrant leaves, and contain both essential oils and tannin. Many of the smaller trees, producing excellent timber for a variety of purposes, are neglected and wasted because they are so dwarfed by the giant Eucalypti as to be considered not worth the cutting. Truly the Eucalypti are noble trees, growing in serried ranks, with a smooth, clean trunk, sixty, seventy, eighty feet and more (sometimes over two hundred), without a limb, and from four to twelve feet in diameter. The wood is hard, strong, and tough; some very free, making excellent shingles and palings; some with the grain interlocked. They contain a resin which is used medicinally, and is called "kino." The leaves give Eucalyptus oil, and the flowers are full of honey. The bark contains fibre suitable for paper, also tannin. The wood is rich in pyroligneous acid, and the twigs and leaves in potash and valuable essential oils. The seeds also are marketable abroad. At present trees are cut down for the seeds alone, or for oil or for timber; but it seems certain that, when the industries of sawing, pulping, and distilling are combined, as well as the utilisation of the small trees that abound among the larger ones, the expenses of each industry will be considerably reduced, the forests will become a large source of revenue, and the old ground be better re-afforested for coming generations than under the present system.

Tasmania, with its temperate climate, reliable rainfall, and land-locked harbours, affords special facilities for the growth and export of timber. Deep arms of the sea run inland, reducing land-carriage to a minimum; and from sheltered inlets the ground rises to a central plateau, where lakes conserve water to feed rapidly-falling streams, which provide ideal sources of motive-power. It is the policy of the Government to encourage legitimate enterprise, and the terms for leases of timbered lands and water-rights are almost nominal, as may be seen by the following extracts:—

## SAWMILL AREAS.

A lease may be obtained on application to the Commissioner of Crown Lands, for a period not exceeding twenty-one years, of an area not exceeding five thousand acres, at an annual rental of one pound for every hundred acres per annum, in advance; and the payment of a royalty of—

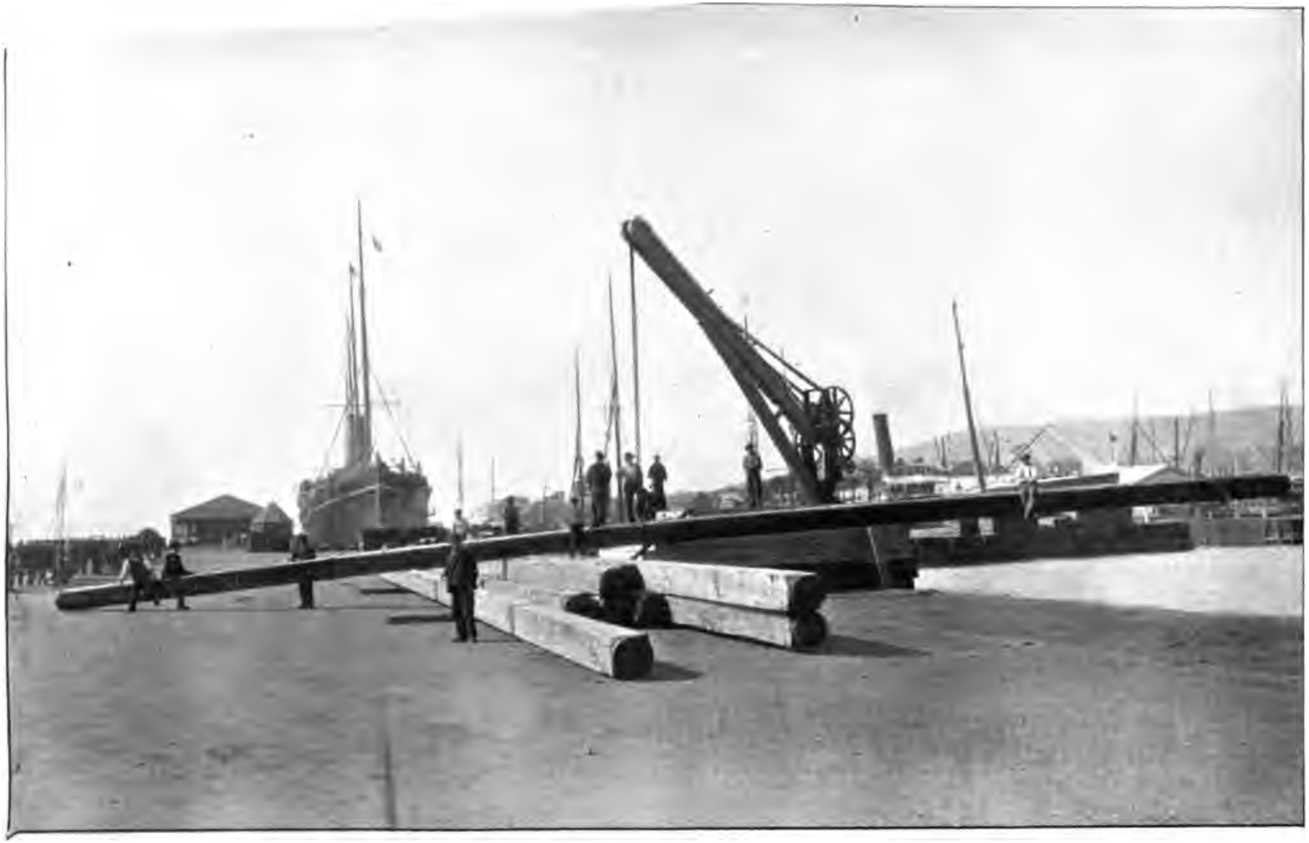
6*d*. per 1000 superficial feet of Eucalyptus timber, cut in the log.
5*s*. ,, ,, ,, ,, of other than Eucalyptus timber, cut in the log.

If a survey is necessary to define the lease, fees have to be paid by the applicant for the lease, at varying rates from five pounds for a fifty-acre block to fifty pounds for a five-thousand acre block, and approved machinery and plant must be put up of a nominal power varying from eight horse-power for a two-hundred-acre block to twenty-five horse-power for a five-thousand-acre block. The lessee must also use due diligence and despatch in removing the timber from his lease, and employ an adequate number of men.

Detailed information may be obtained on application to the Agent-General in London, or to the Commissioner of Crown Lands, Hobart, Tasmania.

## WATER.

The general rate for the use of water is one pound per annum for a flow of twenty-four cubic feet per minute, which is known as a "mining sluice-head."



SHIPPING TIMBER AT HOBART FOR DOVER (Eng.) BREAKWATER

# TASMANIAN TIMBER.

## MYRTACEAE.

### GUM TREES (*Eucalypti*).

Eucalyptus means well-covered, because the flower-bud is covered with a lid, which is forced off when the flower expands.

Of all Tasmanian trees Gum trees are the most remarkable, from the immense size to which they attain, their very general distribution over the Island, and the wide range of uses to which their products may be put. The trunks of these trees are straight and cylindrical for a hundred feet and upwards, with only a small amount of taper; the whole tree will measure from two to over three hundred feet in height; the diameter of well-grown trees, varying from three to six feet commonly, and up to twelve and fifteen feet above the buttresses. Piles have been recently cut for the Admiralty Works, Dover, one hundred and twenty feet long and twenty inches square. Bridge beams and large wharf-timbers also are cut on "the quarter," not sided down out of the round timber, as is done with smaller European trees.

In Tasmania timber is got from the virgin forest, not from plantations or artificially-made forests, as sawmills have not been established for a sufficient length of time for secondary growths of the Gum or Eucalyptus timber to grow to their full size. In consequence of this, trees that are somewhat past their prime may be cut with others. In aged trees the first part to fail is the centre or heart-wood, the wood increasing in strength towards the outside of the tree, the best part being the ring inside the sapwood. This is always borne in mind in getting or inspecting timber; any showing signs of being near the heart is either rejected or very carefully tested. The growing tree and felled timber left in the bush is also subject to the attack of grubs (the larvæ of beetles), which riddle the wood with small holes the size of a pin-head. The holes are so small that the roughness left by the saw will hide them unless carefully looked for, and any timber showing them should be rejected. This is known as "specky timber."

The timbers of the various Eucalypti or Gum so closely resemble each other that it is a matter of great difficulty to say with any degree of certainty from which particular variety any specimen was cut. In the two best-known varieties—Blue Gum and Stringy Bark—the leaves, flowers, fruit, and bark are quite distinct. Blue Gum is, on the average, seven to eight per cent. heavier than Stringy Bark, though mature, slow-grown Stringy Bark will be much heavier than some specimens of Blue Gum, so that identification of the wood after the tree is cut up is difficult.

### BLUE GUM (*Eucalyptus globulus*).

This tree takes its name of *globulus* from the large seed-vessels, which appear of a globular form on the tree. It is named Blue Gum because of the colour of the young growth, which is of a glaucous blue tint. It is found abundantly in the south-west, but is not generally distributed, like the Stringy Bark.

Blue Gum grows up to two hundred feet in height, and one hundred and twenty feet before the first branch springs, with a diameter of from four to ten feet at the butt. The colour of this timber when planed is of a golden yellow to purplish brown or buff. The grain, especially of the butt of the tree, is considerably crossed and interlocked; in the upper portions of the tree the grain is freer, and splits well when green. It is especially esteemed for piles, owing to the large size that it attains, and the comparative immunity it enjoys from the attacks of the Teredo. It is also used for ship and boat building, the superstructure of wharves and bridges; builders' scantlings of all kinds, joists, frames,

FELLING A STRINGY-BARK.

beams, floor-boards; wheelwrights' work, for naves, shafts, swingletrees, felloes, spokes, and body work. It is very durable, both in the water—especially sea-water—and in the air.

In the Exhibition held in Hobart, in 1894, amongst the Government exhibits was a sample of bridge-decking that had been about fifty years under foot-traffic, and which was still hard and sound. A timber also was shown which formed part of the original Bridgewater Ferry punt, built in 1818. The punt had been destroyed by blasting about fifty years before, and the wreck had been lying on the foreshore, between high and low water mark, and where there is Teredo, ever since. This timber, when cut out and planed in 1894, showed no sign of decay, and beyond being stained by the iron fastenings the wood was absolutely fresh. At the same Exhibition were shown bent shafts, turned naves, spokes, and hammer-handles, all cut from Blue Gum timber.

In Tasmania the rainfall of different districts varies from twenty to sixty inches per annum; the Government Railways are ballasted with gravel, and on these railways Blue Gum sleepers six feet six by nine inches by five inches have an average life of fourteen years.

The life of the wharf-piling in Hobart is reported to be twenty-five years. These piles are up to eighty feet in length, and are driven in forty feet of sea-water, where they are subject to the attacks of the Teredo. The oldest wharf now in use was erected in 1868, and has stood till now (1902) without renewal. The waggon ferry-steamer plying across Hobart Harbour, built of Blue gum, has been running about fifty years without any repair or caulking to the hull.

Throughout the country there are several small factories, where the essential oil is extracted from the leaves. This oil is exported for medicinal use and for varnish to various parts of the world, and is probably the only example in which what may be termed the "by-product" of a tree is

utilised in Tasmania. The Blue Gum has been largely planted in Southern Europe, South Africa, America, and India, both for its timber—which it produces more rapidly than almost any other tree—and for the beneficial effect it has upon the climate of marshy and malarial districts. The exhalation of its essential oil and its vigorous circulation together purify the air, and make the soil more healthy.

### RED GUM (*Eucalyptus stuartiana*).

This variety produces timber very similar to the Blue Gum, but of a red-brown colour. It is not a large tree, and is rather branching.

### MUELLER'S GUM (*Eucalyptus Müelleri*).

This is a fine, tall, straight tree, with a very heavy reddish timber, hard and strong, but does not grow in quantity near a shipping port. It is a valuable tree, and appears to stand a considerable amount of frost.

### STRINGY BARK (*Eucalyptus obliqua*).

The distinguishing name *obliqua* is from the leaf; the two lobes of which are unequally divided by the midrib, and the foot-stalk springs from one side obliquely, not from the middle of the end of the leaf. It is termed Stringy Bark from its bark, which is of great thickness and of a fibrous nature.

Stringy Bark trees are very much more widely distributed through the Island than the Blue Gum; growing over large tracts of poor, hilly country, they attain to an immense size, up to three hundred feet in height and from two to ten feet in diameter. The wood is on the whole of a lighter colour than Blue Gum, and varies from a pale straw to a reddish brown. In appearance brown Stringy Bark is somewhat like Oak, and it would be a difficult matter for most people to distinguish a picture-frame made of Stringy Bark from one made of Oak.

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The timber varies very considerably, according to the situation and soil in which the tree grows. In appearance it is freer than Blue Gum, but lacks the purplish tint, and is more subject to gum-veins. It is the most general timber for all sorts of constructive works in this State. It makes excellent piles, especially for fresh water, but is not considered quite so good as Blue Gum for salt water, being more subject to the attacks of the Teredo.

It is also used for shipbuilding, the construction of wharves and bridges, and for railway sleepers; for the dado, flooring, and fitting of houses, and for furniture; it is also an excellent wheelwright's wood. When polished it very much resembles Oak, but has a more sparkling grain; it has a very pretty effect when used for a ballroom floor, or for wainscotting.

Besides being sawn for almost every purpose, Stringy Bark is split into fence-rails, palings, and shingles. It is certain that if this wood and the Blue Gum, properly prepared, were exported to London, a ready sale would be found for it for the construction of carts and vans. It would very well take the place of English Oak and Ash used for this purpose, which are every year becoming scarcer.

In the Tasmanian International Exhibition before-mentioned a Stringy Bark sleeper was shown by the Government that had been twenty-five years under traffic. The usual life of this timber in bridges is from twenty to twenty-five years; sleepers average about fourteen years, and none of the Government Railway buildings—some of which were built twenty-seven years ago, chiefly of this timber—have yet been renewed.

## WOOD PAVEMENT.

The Stringy Bark of Tasmania is especially suited for wood-paving. It is preferable to Jarrah, being quite as durable, gives a better surface, and is also lighter in weight. If properly laid on a good foundation Stringy Bark blocks

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## CORYLACEAE.

### MYRTLE OR BEECH (*Fagus cunninghami*).

This is a true Beech, but the local name is Myrtle, probably so-called from its small dark leaves. It is a tree that grows in great abundance over the western half of the Island. It attains a height of one hundred and fifty feet, with a diameter of from two to four feet.

The wood varies from a greyish-brown to a brown pink; when planed, it takes a beautiful surface, and, like the European Beech, always wears smooth. It is a strong, close-grained timber, and except for the colour, resembles European Beech, but is of considerably greater average strength. If cut from a level of eight hundred feet or upwards above the sea, and felled in the winter, it is a very fairly durable wood for outside work, but it is apt to "go" between wind and water. It makes splendid felloes, staves for tight casks, saddle-trees, gun-stocks, and all sorts of turnery, floors, skirtings, and dados. The pinker tints make handsome furniture. The seasoning and treatment of this timber should be exactly that of European Beech, and it must be felled in the winter to get the best results. Although there are such large quantities of *Cunninghami* to be obtained in the Island, very little of it has been exported hitherto; probably because the chief beds of this timber are not near a shipping port. It is very generally distributed, and produces an excellent timber for a variety of purposes. The difference between the grey and the pink is hard to account for, as they are botanically identical, and there is no apparent reason for the difference.

The railway from Emu Bay to Zeehan now passes through many miles of Beech country, so that there is a better prospect of this timber being utilised.

## ACACIAS.

### BLACKWOOD (*Acacia melanoxylon*).

*Melanoxylon* means blackwood. This tree is very generally distributed, but only grows in single trees or in clumps. It attains a height of sixty to eighty feet, and a diameter of from two to four feet. It is of a dark-brown colour, with reddish rings, but sometimes of a light-brown. It has much the appearance of Walnut, and makes an excellent furniture wood. Some trees are beautifully figured. It is used for all kinds of furniture, including pianos and billiard tables. The timber varies in quality, and the sort where the reddish grain predominates is called, locally, "Pencil Cedar." Again, a third variety, which is of a lighter colour, lighter weight, and freer grain, is called "Lightwood." These three names for varieties of the same timber sometimes cause confusion.

There is a small but steady output of this timber, and it is exported to the other States of the Commonwealth for furniture, carriage-building, and as staves for casks; but there it not sufficient quantity of it, in accessible places, for a large trade.

### SILVER WATTLE (*Acacia dealbatá*).

So called from its blue-green silvery foliage. It is a tree that grows up to fifty or sixty feet in height, with a diameter of from twelve to thirty inches, and produces a somewhat porous timber of a dark-brown to a yellow-brown colour, easily split, fairly tough, and used and exported chiefly for cask staves. It is occasionally used for furniture, and when polished has a very handsome grain.

This timber is not to be had in large quantities. The bark is used for tanning.

### BLACK WATTLE (*Acacia decurrens*).

Called "black" from its dark bark and dark green leaves, and *decurrens* from two lines "running down" from the base of the leaf-stalk. It produces a wood similar to the Silver Wattle, but darker in colour, heavier, and stronger. The bark is so valuable, and largely used for tanning, that very few large trees are to be found. It will grow to a height of forty feet, and a diameter of two feet. It comes up readily from seed in light soils, and may be made a profitable source of income, if systematically cultivated, for the bark.

## CONIFERAE.

### HUON PINE (*Dacrydium franklinii*).

The Huon Pine, so-called from the Huon River, where first found, and also named after Sir John Franklin, is a pine which grows to a great size in the river-bottoms of the West Coast, with a diameter of eight or ten feet, but the ordinary size of the tree will give a plank of from fourteen to thirty inches in width and up to twenty feet in length. The wood is straight-grained, and heavy for a pine, of a bright yellow straw-colour, and very full of an essential oil, which causes it to be almost rot-proof. When made into furniture, the essential oil slowly oxidises, and the wood turns to a smoky-brown colour with age. It is a splendid joiner's wood, and is especially useful for boat-planking, as the teredo objects to the essential oil.

The supply is little more than sufficient for the local demand, but it is a timber that is well worth systematic cultivation. Most of the finest timber grows below flood-level, and it is an exception to the rule that durable timber does not grow in swampy ground, Huon Pine being one of the most durable timbers known. It is not a tough wood, having rather a short fracture, but it steams and bends well. Some trees will cut very handsome figured panels. It has a strong and, to some people, rather a sickly odour. The logs are cut in almost inaccessible gullies, and floated down the streams to the seaport, where they are shipped, generally, to Hobart.

### KING WILLIAM PINE (*Athrotaxis selaginoides* and *Athrotaxis cupressoides—Cypress-like*).

This pine is so named from the leaf resembling the selaginela, an ornamental tree-moss well known in hothouses. It grows on the high lands in the north and west from two to four feet in diameter, and forty or fifty in height. It is not very plentiful. The wood varies in colour from a pinkish-yellow to pink. It is extremely light, and has a scent like cedar, from which it is called "Pencil Cedar" locally. After it is planed up, there is a slight exudation of the resin. It is used for cabinet and joiners' purposes, and for making sculls for racing-boats. Notwithstanding its extreme lightness, it has considerable toughness and strength, and is very durable in the weather, being second only to Huon pine in this respect.

### CELERY TOP PINE (*Phyllocladus Rhomboidalis*).

So called from the leaves in the young plant resembling those of the celery. A heavy, strong pine, of a clear yellow colour, useful for boards, internal fittings, or implements. It is very tough, and the shrinkage so small that the general belief is that it will not shrink at all. The smaller trees furnish masts for small vessels. Though not very plentiful, it is well distributed. This tree might also be very usefully cultivated.

### OYSTER BAY PINE (*Frenela rhomboidea*).

A tree on the East Coast, deriving its name from the locality in which it is chiefly found. It grows from ten to fifteen inches in diameter. The supply of timber from this tree is nominal, as the trees have been nearly all cut out, or burnt, but it is a tree well worth preserving and cultivating, as its timber is of extreme durability. It makes good posts; is also used for hop-poles, gates, and carpenters' work, and is a strong useful timber. It produces a fragrant resin (like gum sanderach) suitable for varnish.

## SASSAFRAS (*Atherosperma moschata*).

This tree grows in creek bottoms to a height of forty to a hundred feet, and from twelve to eighteen inches in diameter. It is a light timber, suitable for wooden pails, brushware, casks, wooden screws, &c., and is a good wood for carving; but it is essential that it should be cut when the sap is down, or it very quickly decays if exposed to weather. The bark and leaves have a pleasant bitter flavour, and the extract is used as a tonic.

# SMALLER TREES OF TASMANIA.

PRODUCING USEFUL TIMBER, WHICH IS NOT EXPORTED.

### LEATHER WOOD (*Eucryphia billardieri*).

A small tree twenty to forty feet in height, with a trunk of from twelve to thirty inches in diameter, producing an excellent pinkish-brown mottled wood, which is very useful in the manufacture of implements, being somewhat akin in nature to the English ash, but stronger.

## TEA TREES.

### MELALEUCA ERICAEFOLIA

### (*Leptospermum lanigerum*) and (*Kunzea corifolia*).

Called "Tea" trees because Captain Cook's sailors are said to have used the leaves for tea.

These trees have a brownish timber, which is very lasting, either in the ground or in the water. The swamp tea-tree grows in salt-water and morasses, and is useful for shelter and the reclamation of land. The leaves, like others of the myrtle tribe, contain essential oils, amongst them, cajeput, which is used medicinally. The timber is used for pick-handles, shafts, wheelwrights' work, paddles, and small piles.

### HE-OAK (*Casuarina suberosa*).

### SHE-OAK (*Casuarina quadrivalvis*).

These are short, bushy trees, growing usually through the open country, having a trunk of six to ten feet and a diameter of eight to ten inches. When green, the colouring of the wood is very rich; but this fades to a brown colour with age. The grain, especially the medullary ray, is very marked, giving the wood a bold figure. At present it is used almost solely for firewood; but it is fairly tough, and useful for implements, and would cut small veneers.

### LANCEWOOD (*Eriostemon squameus*).

A tree of small growth, with wood of a yellow colour, which is fairly tough, and of a very fine grain; useful for shafts, swingle-trees, and implements.

### IRONWOOD (*Notelaea ligustrina*).

This is a handsome tree, giving a trunk of ten or twelve feet, with a diameter of from one to two feet. The outer, or sap-wood, is yellow, and the heart-wood of a dark brown, getting darker with age. It is extremely hard, and is used in place of lignum vitæ, also for tools of various kinds.

### HORIZONTAL (*Anodopetalum biglandulosum*).

A small-growing tree, which branches over the surface of the ground and forms impenetrable thickets on the West Coast. Before it is thoroughly dry it is of extreme toughness, almost impossible to break. It is used for tool-handles and implements. When dry it has not the toughness of English Ash, or American Hickory.

### DOGWOOD (*Pomaderris apetala*).

A small tree growing thirty to fifty feet in height, but only up to ten inches in diameter. The wood is similar to that of the English pear tree, and is useful for carving, fine turners' work, and drawing instruments.

### MUSK (*Olearia argophylla*).

A small tree producing a hard brownish wood useful for furniture. Some of the boles would cut veneers of good figure.

### HONEYSUCKLE (*Banksia marginata*).

This is widely dispersed over the open country, and produces a very curious yellow to pinkish-brown wood of a reticulated or netted appearance. Larvæ of certain moths and beetles are so fond of this tree, that it is extremely difficult to get a sound plank of any size.

### TALLOWWOOD (*Pittosporum bicolor*).

A small tree producing a yellow smooth-grained wood useful for implements and furniture.

### BOX (*Bursaria spinosa*).

A handsome bushy tree, with white, sweet-scented flowers; the wood is ivory in colour, and of an even grain, suitable for carving or engraving-blocks. This wood is also very much eaten by larvæ, and it is difficult to find a tree over ten inches in diameter that is not perforated.

### NATIVE CURRANT (*Leptomeria billardieri*).

This tree grows little larger than a bush, but produces a very nice yellowish-brown timber useful for small tools, also for ornamental works and boat-knees.

### PINKWOOD OR ROSEWOOD (*Beyera viscosa*).

A small tree with a reddish wood, something like the Rosewood of commerce, but of very small size. It is used for ornamental work and tools.

### WARATAH (*Telopea truncata*).

This tree may be got up to six inches in diameter. It is famed for its flowers; but the wood is also used for ornamental joiners' work, and has a very pretty grain.

**LABURNUM** (*Goodia lotifolia*).

**NATIVE LAUREL** (*Anopterus glandulosus*).

**MINT TREE** (*Prosthanthera lasianthes*).

All the above are small trees, occasionally used for inlaying and turnery.

### NATIVE BIRCH (*Dodonea viscosa*).

Has a pink sap and a dark heart-wood of extreme hardness, but this tree rarely grows to any size in Tasmania; it is useful for rulers, turnery, &c.

### NATIVE CHERRY (*Exocarpus cupressiformis*).

This tree will grow a trunk of six or eight feet long by ten inches in diameter; the wood is a warm red brown. It is used in cabinet work, but is not of commercial value. Its claim to notice is that the fruit is spoken of as the "Australian Cherry," which grows the stone outside instead of in the centre of the fruit; though, as a matter of fact, the fruit is more like that of the Yew-tree than the Cherry.

## COMPARATIVE TABLE OF WEIGHTS AND TRANSVERSE STRENGTHS OF EUROPEAN AND TASMANIAN TIMBERS.—(A. O. GREEN.)

| NAME OF TIMBER. | lbs. weight per cubic foot. | | | Transverse strength $\frac{LW}{4bd^2}$ | | | EXPERIMENTERS |
|---|---|---|---|---|---|---|---|
| | Min. | Max. | Mean. | Min | Max. | Mean. | |
| Ash, English | 43 | 53 | 47 | 1471 | 2445 | 2130 | Barlow, P. W. Barlow, Beaufoy, Denison, Ebbels, Peake and Barrallier, Tredgold, and Rankin. |
| Beech „ | 37 | 50 | 43 | 1557 | 2031 | 1794 | |
| Yellow Deal (Sylvestris) | 30 | 44 | 36 | 1183 | 2058 | 1600 | |
| Oak, English | 43 | 62 | 54 | 1092 | 2892 | 1788 | |
| Blue Gum, Tasmanian, Fresh Cut | 60 | 80 | 73 | 1957 | 2100 | 2019 | Mitchell, Green, Mann |
| „ „ Dry | 52 | 67 | 60 | 1867 | 3361 | 2706 | Mitchell, Laslett, Green |
| Stringy Bark … Fresh Cut | 55 | 75 | 69 | 1377 | 2046 | 1874 | Kernot, Green |
| „ … Dry | 48½ | 66 | 57 | 2514 | 3661 | 3273 | Mitchell, Ransome, Green |
| Gum Top Stringy Bark … „ | 48½ | 51 | 50 | 1524 | 2391 | 1958 | Kernot, Victorian Timber Board, Green |
| Swamp Gum … „ | .. | .. | 54 | 1400 | 3334 | 2367 | Green |
| Peppermint … „ | 50 | 65 | 59 | 1599 | 1646 | 1623 | R. M. Johnson Green |
| White Gum … „ | 44 | 48 | 46 | 1646 | 1788 | 1717 | R. M. Johnson, Green |
| Myrtle or Beech … „ | 39 | 54 | 47 | 2712 | 2946 | 2804 | Ransome, Green |
| „ „ … Fresh Cut | .. | .. | 67 | .. | .. | 2257 | Kernot |
| Leatherwood … Dry | 42 | 49 | 45 | .. | .. | 3258 | Green |
| Celery Top Pine … Fresh Cut | .. | .. | 64 | .. | .. | 1378 | Kernot |
| „ „ „ … Dry | 40 | 44 | 42 | 2124 | 2326 | 2225 | Kernot, Green |

## TASMANIAN - AUSTRALIAN TIMBERS.

(A. O. Green.)

Approximate Breaking Weights for Stresses, of Crushing, Shearing, and Tension, in pounds per square inch, from experiments of Professor Kernot, Melbourne University.

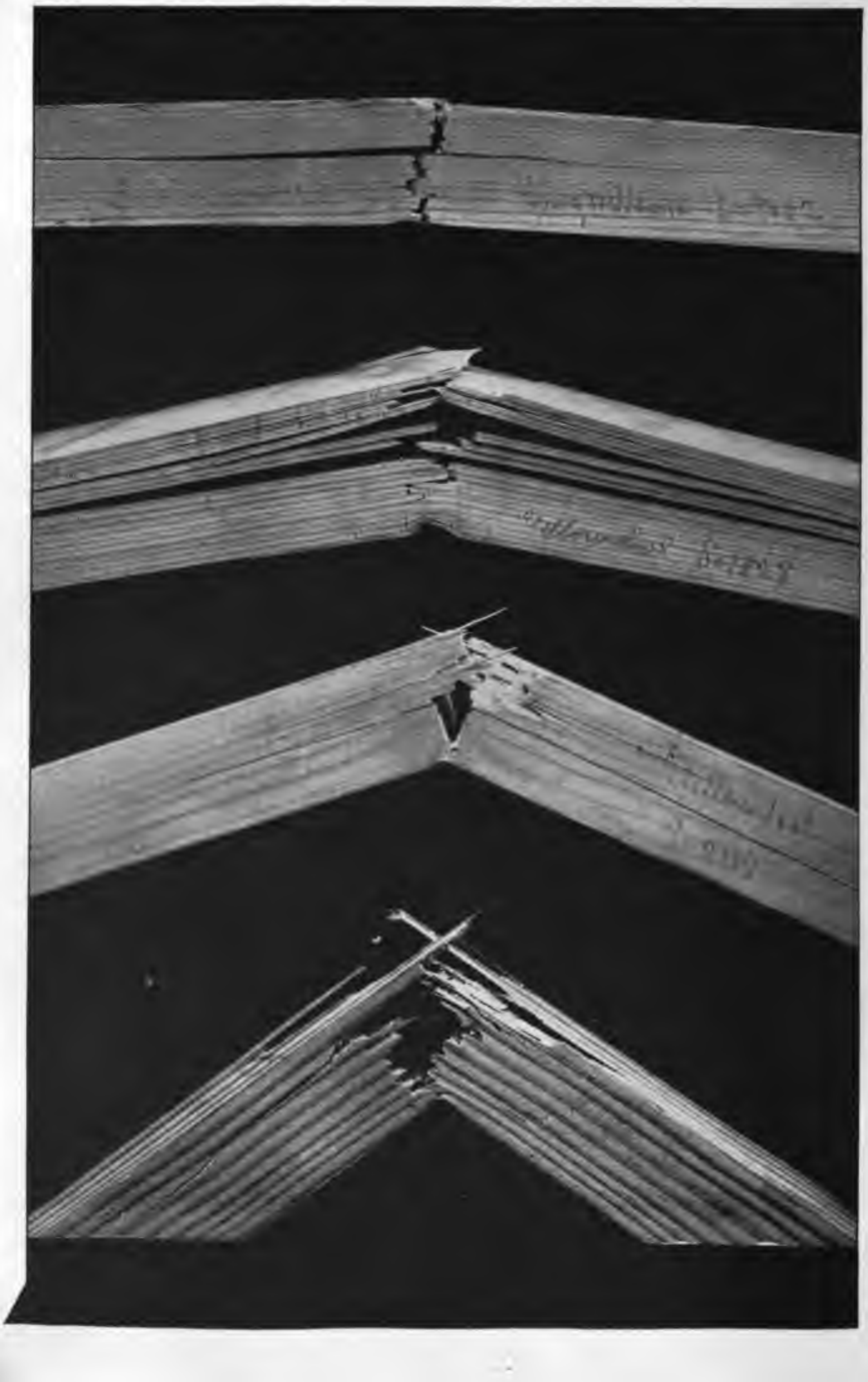
| | Crushing along the grain. | Crushing across the grain. | Shearing across the grain. | Tension along the grain. | Tension across the grain. |
|---|---|---|---|---|---|
| Stringy Bark.. Fresh cut | 4400 | 2000 | 2000 | 10,000 | |
| ,, .. Dry* | 8000 | 4500 | 2000 | 22,000 | |
| Blue Gum ... Fresh cut | — | — | — | — | |
| ,, .. Dry* | 9000 | 4500 | 2000 | 22,000 | |
| Leatherwood.. Fresh cut | — | — | — | — | |
| ,, .. Dry* | 8000 | 6000 | 2000 | — | |
| Myrtle ... .. Fresh cut | 5000 | — | — | 10,000 | |
| ,, .. Dry* | 7000 | 4500 | 3000 | 12,000 | |
| Celery-top Pine ...... Fresh cut | 4000 | — | — | 3000 | |
| ,, .. Dry* | 7000 | 1000 | 1400 | 12,000 | |

## EUROPEAN TIMBERS.

| | Crushing along grain. | | | Tension along grain. | | | Tension across grain. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Mean. | Min. | Max. | Mean. | Min. | Max. | Mean. |
| Ash dry | 8700 | 9500 | 9000 | 16,000 | 19,600 | 17,600 | — | — | — |
| Bee | 7700 | 9500 | 8500 | 11,000 | 22,000 | 17,000 | — | — | — |
| Oak ,, | 6500 | 10,000 | 8300 | 9000 | 20,000 | 13,600 | — | — | 2316 |
| Deal ,, | 5500 | 6500 | 6000 | 12,000 | 18,000 | 15,400 | 540 | 840 | 626 |

* Note.—For Australian timbers, and given as an approximate guide, for the breaking weights of Tasmanian timbers, data for which are wanting. The weights given for European timbers are from results obtained by the experimenters enumerated at the head of the Table of Weights and Transverse Strengths on page 29.

For purposes of comparison, the "Shearing across the grain" shown for the Tasmanian woods may be taken as equivalent to the "Tension across the grain" shown for European.



# TRANSVERSE STRENGTH, DEFLECTION, AND ELASTICITY.

(A. O. GREEN.)

---

*Experiments made in Hobart in May, June, and July, 1902.*

Size of specimens 30 x 1 x 1 inches, of Tasmanian timbers of the ordinary quality accepted by the Tasmanian Government Railway Department for maintenance purposes—the Deal and Oregon the best that could be got. The time of each experiment was about an hour. About three-fourths of the load was put on slowly, with thirty-pound lead-weights; then fourteen pounds, then lighter weights, until the breaking load was attained; all at about the rate of thirty pounds in five minutes.

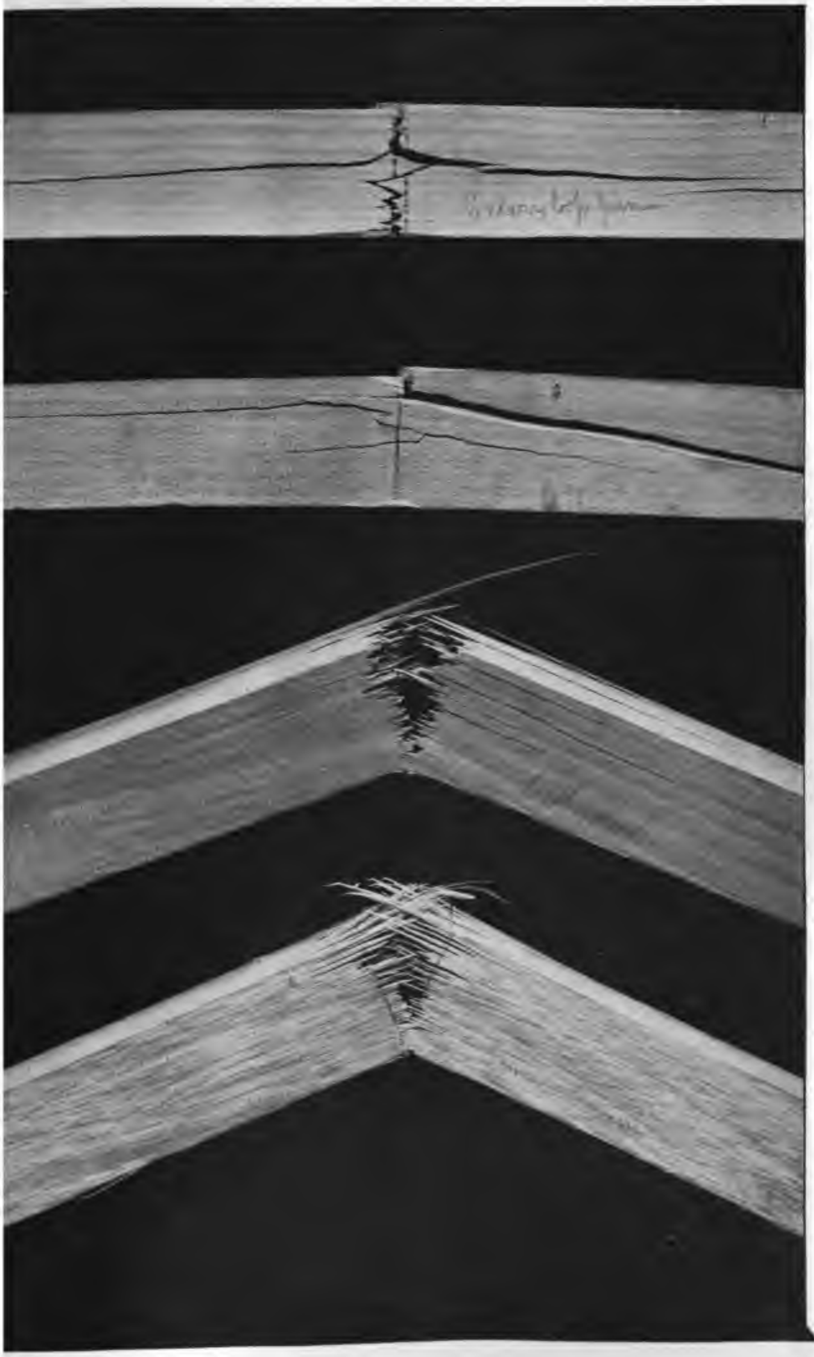
The specimens were supported on fixed wooden supports of two feet clear span, and the weights were placed in a scale-pan hung on the centre of the specimen by a half-inch shackle. The specimens weighed from half to about a pound each, but this weight is neglected in the deductions.

In all the experiments but two the sap-side was down and the heart up. The deflection was taken by means of a scale divided to fiftieths of an inch, standing on the specimen and against a fixed board, with a vernier, bridging the span.

In the accompanying table the symbols used in the formulæ are as follows:—W = weight in pounds, L = length in inches, b = breadth in inches, d = lepth in inches, $\delta$ = deflection in inches, $l$ = length in feet. S, E and A are constants for transverse breaking "Strength," modulus of "Elasticity," and for the stiffness of beams, the deflection of which does not exceed one four-hundred-and-eightieth of the span. The last, A, is Tredgold's formula for the stiffness of beams, which is often quoted in tables for European timbers where depth in inches, $d = \sqrt[3]{\frac{l^2 W A}{b}}$ and $\delta = \frac{l}{480}$. $S^{\times}$= the breaking-weight of a beam 1 foot x 1 inch x 1 inch, supported at the ends and loaded in the centre.

## EXPERIMENTS MADE IN HOBART, 1902, BY A. O. GREEN.

| Date cut. | Name of Timber. | Weight per cubic foot. | $\delta$ $\frac{WL^3}{4bd^3E}$ Deflection Load 100 lbs. | W $\frac{4bd^2S}{L}$ Breaking Weight. | S $\frac{LW}{4bd^2}$ Specific Transverse Strength. | E $\frac{WL^3}{4bd^3\delta}$ Mean Modulus of Elasticity. | A $\frac{40bd^3\delta}{Wl^3}$ Constant for Stiffness. | S× Breaking Weight of beam 1ft. × 1in. × 1in. supported at ends and loaded in middle. |
|---|---|---|---|---|---|---|---|---|
| | | lbs. | inches. | lbs. | lbs. | lbs. | | |
| | TASMANIAN TIMBERS. | | | | | | | |
| 1892 | *Eucalyptus obliqua.*<br>Stringy Bark, dry ...... | 60·1 | ·115 | 610¼ | 3661 | 2,988,939 | ·0058 | 1220 |
| 1900 | *Eu. globulus.*<br>Blue Gum, dry .......... | 59·2 | ·170 | 560¼ | 3361 | 2,048,047 | ·0085 | 1120 |
| 1894 | *Eu. Regnans.*<br>Swamp Gum, dry ........ | 53·6 | ·100 | 555¾ | 3334 | 3,423,086 | ·005 | 1111 |
| 1894 | ***Eucryphia billardieri.***<br>**Leatherwood, dry .......** | 48·6 | ·150 | 543 | 3258 | 2,283,927 | ·0076 | 1086 |
| 1894 | ***Fagus Cunninghamii.***<br>**Myrtle or Beech, dry ...** | 54·0 | ·210 | 491 | 2946 | 1,626,287 | ·0106 | 982 |
| 1894 | ***Phyllocladus Rhomboidalis.***<br>**Celery-top Pine. dry...** | 40·3 | ·238 | 387¾ | 2326 | 1,447,775 | ·0121 | 775 |



| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1902 | Unseasoned<br>Stringy Bark ............ | 58·8 | ·155 | 341 | 2046 | 2,263,680 | ·0076 | 682 |
| 1902 | Unseasoned<br>Blue Gum.................. | 69·7 | ·195 | 326¼ | 1957 | 1,759,963 | ·0098 | 652 |
| 1894 | *Athrotaxis Selaginoides.*<br>King William Pine, dry | 22·1 | ·650 | 182 | 1092 | 541,975 | ·0319 | 364 |
| | IMPORTED PINES. | | | | | | | |
| Un-known | *P. Douglassii.*<br>Oregon Pine, dry ....... | 34·4 | ·180 | 378¾ | 2273 | 1,937,728 | ·0089 | 758 |
| „ | *P. Sylvestris.*<br>Yellow Deal, Annual Rings vertical* ......... | 30·25 | ·188 | 353 | 2118 | 1,879,417 | ·0092 | 706 |
| „ | Yellow Deal, Annual Rings horizontal* .... | 31·7 | ·195 | 304¾ | 1828 | 1,769,037 | ·0098 | 609 |
| | ENGLISH TIMBER.† | | | | | | | |
| | *Fraxinus Excelsior.*<br>Ash, English, dry ....... | 47· | ·211 | 333 | 2000 | 1,640,000 | ·01 | 666 |
| | *Fagus Sylvatica.*<br>Beech, English, dry .... | 43· | ·257 | 333 | 2000 | 1,345,000 | ·013 | 666 |
| | *Quercus Vars.*<br>Oak, English, dry....... | 58· | ·243 | 282 | 1690 | 1,420,000 | ·013 | 563 |

* Both cut from same deal.

† Highest values for English timbers from Molesworth's Engineering Pocket Book.

In the dry woods the elasticity was unimpaired to ¾ of breaking strain; in the green ones to about a half.

The nature of the fracture in each case will be seen from the illustrations. Tasmanian trees are very large, and may be got quite free from knots and with the grain evenly hard, so that the above may be taken as ultimate breaking-weights of well-selected timber free from shakes and defects.

The results obtained for Deal could not be got in ordinary work, except with small scantlings, chiefly owing to the presence of knots; also, from the trees being small, the hard grain may be at many angles in a single plank. From these causes the timber does not give evenly throughout, and a large plank will not carry so much weight in proportion to its size as a small one will, in which these causes of failure have been eliminated.

## TASMANIAN AND OTHER TIMBERS.

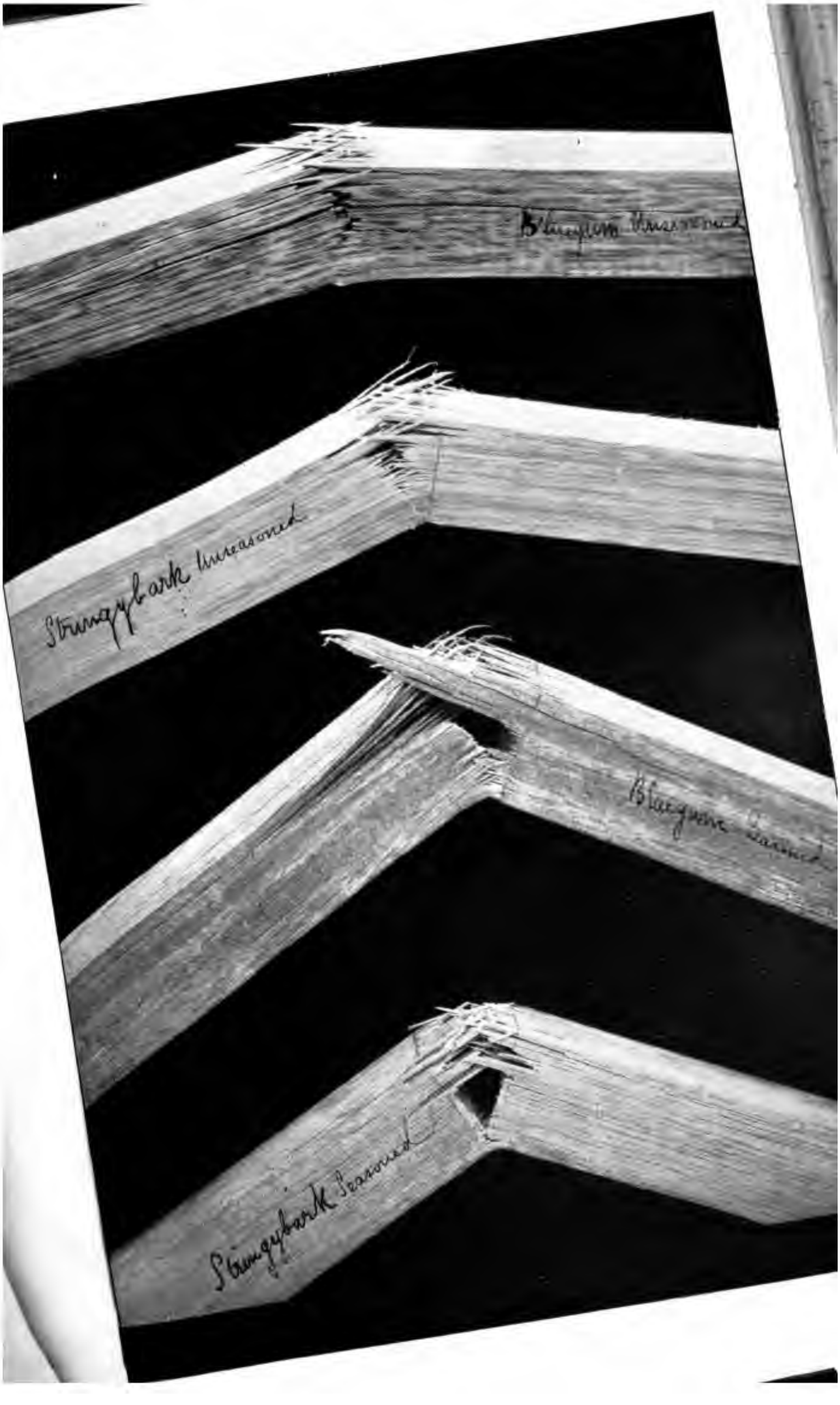
(A. O. Green.)

Arranged in order of stiffness from the deflections of specimens one inch square, supported at ends, span two feet and load one hundred pounds in centre of span.

| Name. | W = 100 lbs. Deflection inches. | Breaking load. lbs. | Deflections at breaking. |
|---|---|---|---|
| Swamp Gum ..................dry | ·100 | 555¾ | 1·1 |
| Stringy Bark .................. ,, | ·115 | 610¼ | 1·0 |
| Leatherwood .................. ,, | ·150 | 543 | 1·5 |
| Stringy Bark .............fresh cut | ·153 | 341 | 1·1 |
| Blue Gum ....................dry | ·170 | 560¼ | 1·1 |
| Oregon Pine .... ............ ,, | ·180 | 379 | 1·25 |
| Yellow Deal—annual rings vertical* ,, | ·188 | 353 | 1·0 |
| Yellow Deal—annual rings horizontal*.......... ...........dry | ·195 | 304¾ | 1·1 |
| Blue Gum ................fresh cut | ·195 | 326¼ | 1·2 |
| Myrtle or Beech ..............dry | ·210 | 491¼ | 1·4 |
| Ash, English........... ,, | ·211† | — | — |
| Celery Top Pine............ .... ,, | ·238 | 387¾ | 1·1 |
| Oak, English .................. ,, | ·243† | — | — |
| Beech, English ................ ,, | ·257† | — | — |
| King William Pine . .......... ,, | ·655 | 182 | 1·655 |

* Cut side by side from one Deal.

† Calculated from the value of E given in Molesworths' Engineering Pocket Book.


Bluegum Unseasoned
Stringybark Unseasoned
Bluegum Seasoned
Stringybark Seasoned

The values given in the preceding tables for S, the transverse strength of a beam supported at the ends, and loaded in the centre of the clear span, are for breaking-weights, but the working load should never exceed one-third of this for static loads or one-sixth for moving loads; it is usual practice to take one-fourth for static and one-eighth for moving loads. The practice for railway bridges is one-fifth for static and one-tenth for moving loads.

To find the deflection that any weight in the centre of span will cause in a rectangular beam of any of the woods given in the table, supported at the ends—$\delta = \frac{W L^3}{4 b d^3 E}$ Multiply the weight in pounds by the cube of the length in inches, and divide the product by the product of four times the breadth, by the cube of the depth and by the value given for E in the table.

To find the breaking-weight in a rectangular beam of any of the woods given, loaded in the same way, $W = \frac{4 b d^2 S}{L}$ or multiply four times the breadth by the square of the depth by the value given for S, and divide the product by the length in inches. Or, by using the column $S^{\times}$, multiply the breadth by the square of the depth in inches by $S^{\times}$, and divide the product by the length of span in feet; or, by formula $W = \frac{b d^2 S^{\times}}{l}$

Again given the span in feet, the load in pounds, and the breadth in inches, of a beam, to find the depth in inches, so that the beam shall not bend more than one-fortieth of an inch to a foot, or one four-hundred-and-eightieth of its span, the formula is $\sqrt[3]{\frac{l^2 W A}{b}}$, or multiply the square of the length in feet by the load in pounds by the value given for A, and divide the product by the breadth in inches; this will give the cube of the depth, and the cube-root will be the result required.

It must be remembered to add half the total weight of the beam itself to the load for the total centre load upon the beam in all cases.

## SEASONING AND SHRINKAGE.

Rankin's "Machinery and Millwork," page 471:—

Seasoning for carpenters, two years; for joiners, four years, and often much longer.

Shrinkage 2 to 8% transverse, usually 3%; loss of weight 6 to 40%.

Molesworth's "Engineers' Pocket-book," page 113, Mahogany, Walnut, or Oak seasoning:—

| Inches of Thickness | ⅜″ | ½″ | ⅝″ | ¾″ | ⅞″ | 1″ | 1½″ | 2″ | 3″ | 4″ |
|---|---|---|---|---|---|---|---|---|---|---|
| Months of Time | 12 | 13 | 14 | 16 | 20 | 24 | 30 | 36 | 46 | 52 |

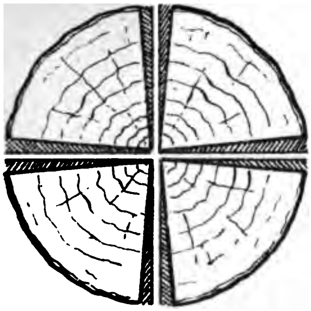
Barlow gives the shrinkage of Oak as 3% for the butt, 5% for the top, and the loss of weight as, at least, a third in drying.

T. A. Knight, in "Philosophical Transactions," vol. 107, p. 269, shows that Ash and Beech cut on the back, or parallel to the rings of growth, shrank 14% of the width, and warped; while the same cut on the quarter, or across the rings of growth, shrank 3½% of its width, and did not warp.

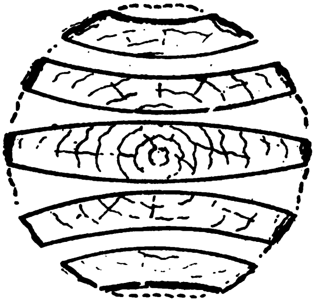
Tredgold quotes Rondelet's experiments, showing that ordinarily dry Fir will expand up to 1⅓% of width, and Oak to 1¼%, under ordinary changes in the dampness of the atmosphere.

Tasmanian timbers lose from 22% to 40% of their weight in drying. The usual allowance for the shrinking of Tasmanian hardwood is from half an inch to an inch to the foot, or 4 to 8%; but this is only a rough general assumption, and no exact experiments have been made for the determination of the shrinkage. It is known generally that it varies considerably in the different timbers, that of Celery-top Pine being the least, and that of Stringy Bark probably the greatest; while, from the same kind of tree, timber grown on good moist land will shrink more than that grown upon poor rocky soil, and the young wood more than that of matured trees. It would be very useful indeed if the percentage of shrinkage, both radially and along the rings, were settled by experiment, for each kind of timber.

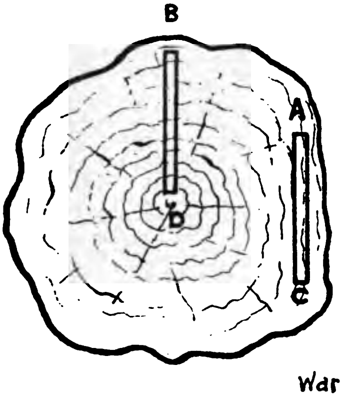
With regard to seasoning (most Tasmanian timber is sold unseasoned), the practice in England is given above, but after the length of time allowed for seasoning, for carpentry and the rougher sorts of work, the joiners will either season for several years more, or further dry the timber in a hot room before using it. During the time of drying, the timber is carefully stacked with numerous slats between the planks, and sufficiently weighted to keep it from buckling. As has



If a log is cut in four through centre, as the shrinkage is along the ring, the angle at centre will become less than 90° in drying. Also, the wood of the outer layers of the tree being less consolidated, shrinks more than that near the centre.



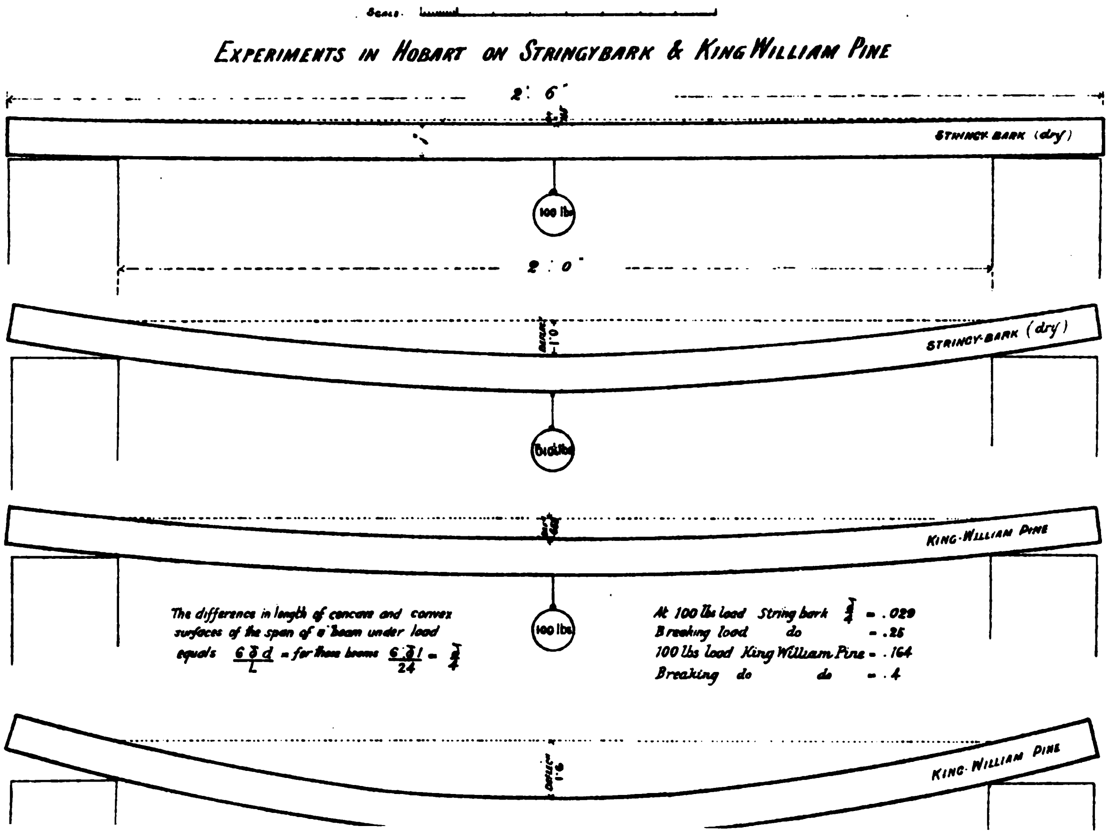
Shows shrinkage of plank from above cause.



B. D. on quarter
A.C.. on back.

See Tredgold; Joinery, Edition 7. Ency. Brit., Knight F.A. 91 Vol. Phil Trans. experiment on Oak, also, Vol. cvii. p269. - - Ash & Beech cut on back or parallel to rings shrunk up to 14% of width and warped, the same cut on quarter 3½% of width & did not warp.

# EXPERIMENTS IN HOBART ON STRINGYBARK & KING WILLIAM PINE



The difference in length of concave and convex surfaces of the span of a beam under load equals $\frac{6\,\delta\,d}{L}$ = for these beams $\frac{6\,\delta\,1}{24} = \frac{\delta}{4}$

At 100 lbs load Stringbark $\frac{\delta}{4}$ = .029
Breaking load do = .25
100 lbs load King William Pine = .164
Breaking do do = .4

been before stated, one of the essentials of placing Tasmanian timber on the European market in plank is that it should be well seasoned and properly stacked during the seasoning.

The length of time given above as the practice of air-seasoning in Europe may be shortened to a few months by the use of properly-constructed drying-rooms, in which green timber can be stacked, slatted, weighted, and dried, at a temperature of from 100° to 140° Fahrenheit. The room should be so arranged that the atmosphere within it may be kept saturated with moisture, in order that the outer part of the timber shall not dry before the inner; this can be very readily done by the use of exhaust-steam. Towards the end of the process the moisture should be gradually diminished, and the timber allowed to dry off, and cool slowly. There is little doubt but that excellent results would be obtained at a very moderate cost from this treatment.

## SUNDRY WEIGHTS OF ROUND, SPLIT, AND SAWN TIMBER.—(A. O. GREEN.)

Blue gum Piles at 75 lbs. a cubic foot.

| Diameter in feet and inches— | 1′ 0″ | 1′ 4″ | 1′ 8″ | 2′ 0″ | 2′ 6″ | 3′ 0″ | 4′ 0″ |
|---|---|---|---|---|---|---|---|
| Weight per foot run of pile in pounds .. ... About | 59 | 104 | 163 | 236 | 368 | 530 | 942 |
| Number of running feet to a ton ... ... ... About | 38 | 21½ | 13¾ | 9½ | 6 | 4½ | 2⅓. |

Stringy-bark piles weigh about 69 lbs. a cubic foot, or say 10 per cent. less than blue-gum.

Other Tasmanian woods weigh from 55 lbs to 70 lbs. a cubic foot in the log.

One foot super. or board measure of hardwood fresh cut weighs 5¾ lbs. to 6 lbs.

| | | | | | |
|---|---|---|---|---|---|
| 8⅓ | cubic feet or | 100 | feet super of | fresh cut stringy-bark | weighs about 560 lbs. |
| 8⅓ | ,, | 100 | ,, | dry stringy-bark | ,, 450 lbs. |
| 8⅓ | ,, | 100 | ,, | imported deal | ,, 373 lbs. |

## THE FOLLOWING QUANTITIES WEIGH ABOUT A TON.

*Timber.*

| Cubic feet. | Super. feet. | |
|---|---|---|
| 33· | or 400 | of hardwood is usually considered a ton = 68 lbs. a cubic foot. |
| 32·6 | or 390 | of fresh cut stringy-bark = 68·7 lbs. a cubic foot |
| 30· | or 360 | of fresh cut blue gum = 74· ,, ,, |
| 32· | or 384 | of fresh cut blackwood = 70· ,, ,, |
| 37·3 | or 448 | of fresh cut wattle = 60· ,, ,, |
| 50· | or 600 | of imported pine or deal is usually considered a ton = 45 lbs. a cubic foot. |
| 66· | or 792 | of deal dry enough for use is considered by English builders a ton = 34 lbs. a cubic foot. |
| 60· to 72· | or 840-864 | of deal thoroughly dry weighs a ton = 30 to 32 lbs. a cubic foot. |

## *Sleepers, Posts, and Rails.*

| No. to a ton. | | | | Cubic feet. |
|---|---|---|---|---|
| 12·34 | blue gum sleepers | 7′ × 10″ × 5″. | 1 sleeper = | 2·4305, and weighs 182 lbs. |
| 13·3 | stringy-bark sleepers | 7′ × 10″ × 5″. | 1 sleeper = | 2·4305, and weighs 168 lbs. |
| 14·7 | blue gum sleepers | 6′ 6″ × 9″ × 5″. | 1 sleeper = | 2·031, and weighs 152 lbs. |
| 16· | stringy-bark sleepers | 6′ 6″ × 9″ × 5″. | 1 sleeper = | 2·031, and weighs 140 lbs. |
| 27·2 | stringy-bark posts | 7′ × 7″ × 5″ × 2″. | 1 post = | 1·191, and weighs 82·2 lbs. |
| 51 | stringy-bark fence rails | 9′ × 7″ × 2″ × 1″. | 1·55 rails = | 1 cubic foot. |
| 70 | ” ” | 9′ × 6″ × 2″ × ½″. | 2· rails = | 1 cubic foot. |

## *Firewood.*

80 Cubic feet of green gum weigh about a ton.
100 Cubic feet of dry gum ” ” ”

## *Staves.*

| No. to a ton. | | | |
|---|---|---|---|
| 504 | Wattle | 2′ 8″ × 4″ × 1″ | About 13½ staves = 1 cubic foot. |
| 432 | Blackwood | 2′ 8″ × 4″ × 1″ | |
| 298 | Wattle | 3′ 2″ × 5½″ × $1\frac{1}{16}$ | About 8 staves = 1 cubic foot. |
| 256 | Blackwood | 3′ 2″ × 5½″ × $1\frac{1}{16}$ | |
| 298 | Wattle | 4′ 0″ × 4½″ × 1″ | About 8 staves = 1 cubic foot. |
| 256 | Blackwood | 4′ 0″ × 4½″ × 1″ | |

## *Stringy-bark Palings.*

| | | | |
|---|---|---|---|
| 308 | palings | 6′ × 6″ | 5 palings split from a billet 6″ × 2¼″ × 2″ at the end. |
| 370 | ” | 5′ × 6″ | |
| 350 | ” | 6′ × 6″ | ” ” split from a billet 6″ × 2¼″ × 1½″ at the end. |
| 429 | ” | 6′ × 5″ | |

## *Shingles.*

40 bundles of 96 each, 3840 shingles to a ton ; each bundle weighs ½ cwt.

## *Apple Cases.*

Long Apple Case—

| No. to a ton, | | | |
|---|---|---|---|
| 768 | top, bottom, and side palings | 2′ 4″ × 7″ × ⅓″, | 26 = 1 cubic foot. |
| 665 | ends and divisions ............... | 1′ 2″ × 7″ × ⅞″, | 20 = 1 cubic foot. |

Timber for 90 long apple cases weighs about a ton.
Timber for 145 half cases weighs about a ton.

Dump Apple Case—

| No. to a ton. | | | |
|---|---|---|---|
| 1221 | side palings ............... | 1′ 8″ × 7″ × ⅓″, | 38½ = 1 cubic foot. |
| 895 | top and bottom palings | 1′ 8″ × 9½″ × ⅓″, | 27 = 1 cubic foot. |
| 460 | ends ........................ | 1′ 3″ × 9½″ × ⅞″, | 14 = 1 cubic foot. |

Timber for 100 dump apple cases weighs about a ton.

## HOBART PRICES.

### LOGS—Per 100 feet super.

| | |
|---|---|
| Gum or Hardwood | 3*s*. 9*d*. to 4*s*. |
| Blackwood | 10*s*. |
| Huon Pine | 14*s*. |

### PILES.

1*s*. to 2*s*. 6*d*. a foot run for small.
2*s*. 6*d*. to 4*s*. 6*d*. a foot run for large.

### SCANTLINGS—Per 100 feet super.

| | |
|---|---|
| Gum, Quartering | 5*s*. |
| „ Large | 7*s*. to 10*s*. |
| „ Bridge beams | 10*s*. to 20*s*. |

### ONE-INCH BOARDS—Per 100 feet.

| | |
|---|---|
| Gum | Green, 7*s*.; dry, 8*s*. 6*d*. |
| „ Tongued and grooved | 11*s*. |
| „ Weatherboards, dressed | 8*s*. 6*d*. |
| Huon Pine, 1-inch boards | 25*s*. |
| Blackwood, „ | 25*s*. |

### SUNDRIES.

| | |
|---|---|
| Gum, Cart shafts | 3*s*. per pair. |
| „ Cart felloes | 8*d*. each. |
| „ Spokes | 10*s*. per 100. |
| „ Fence posts | 40*s*. to 50*s*. per 100. |
| „ Fence rails | 30*s*. per 100. |
| „ 5-ft. palings | 7*s* 6*d*. per 100. |
| „ 6-ft. palings | 8*s*. 6*d*. per 100. |
| „ Sawn lathes | 10*s*. per 1000. |
| „ Shingles | 10*s*. 6*d*. per 1000. |

### STAVES.

| | |
|---|---|
| Wattle staves, 2 ft. 8 ins | 8*s*. per 100. |
| „ 4 ft. | 10*s*. per 100. |
| Blackwood staves, 3 ft. 2 in. | 12*s*. per 100. |
| Gum Top, called White Oak, 2 ft. 8 in. | 8*s*. per 100. |

## LIST OF TASMANI

| Local Name. | Family. | Species. | Length and diameter of trun |
|---|---|---|---|
| BEECH or MYRTLE | Corylaceæ | Fagus cunninghamii | 40 ft. × 2 ft. to 4 |
| BIRCH | Sapindeæ | Dodonæa viscosa | 3 ft. × 6 in. |
| BLACK WATTLE | Leguminosæ | Acacia decurrens | 12 ft. × 1 ft. 6 in. |
| BLACKWOOD | „ | „ melanoxylon | 30 ft. × 2 ft. to 4 |
| BOOBYALLA | Myoporaceæ | Myoporum insulare | 3 ft. × 6 in. |
|  | Leguminosæ | Acacia longifolia | 4 ft. × 8 in. |
| BOX, NATIVE | Pittosporeæ | Bursaria spinosa | 6 ft. × 1 ft. 6 in |
| DOGWOOD | Rhamneæ | Pomaderris apetala | 10 ft. × 10 in. |
| GUM, BLUE | Myrtaceæ | Eucalyptus globulus | 120 ft. × 2 ft. to 6 |
| „ CIDER | „ | „ gunnii | 20 ft. × 2 ft. |
| „ IRONBARK | „ | „ sieberiana | 40 ft. × 4 ft |
| „ MUELLER'S | „ | „ muelleri | 80 ft. × 3 ft. |
| „ PEPPERMINT | „ | „ amygdalina | 100 ft. × 3 ft. to 6 |
| „ RED | „ | „ stuartiana ? | 60 ft. × 3 ft. |
|  |  | „ acervula |  |
| „ STRINGY BARK | „ | „ obliqua | 120 ft. × 3 ft. to 6 |
| „ TOPPED STRINGY BARK | „ | „ hæmastoma ? | 100 ft. × 3 ft. to 4 |
|  |  | „ amygdalina var. |  |
| „ SWAMP | „ | „ regnans | 100 ft. × 3f. to 8ft |
| „ WEEPING | „ | „ coriacea | 10 ft. × 2 ft. |
|  |  | „ pauciflora |  |
| „ WHITE | „ | „ viminalis | 80 ft. × 3 ft. to 6 |
| HE-OAK | Casuarineæ | Casuarineæ suberosa | 4 ft. × 1 ft. |
| HOLLY or COFFEE PLANT | Rubiaceæ | Coprosma hirtella | 3 ft. × 6 in. |
| HONEYSUCKLE | Proteaceæ | Banksia marginata | 6 ft. × 1 ft. to |
| HORIZONTAL | Saxifrageæ | Anodopetalum biglandulosum | 12 ft. × 10 in. |
| IRONWOOD | Oleaceæ | Notelæa ligustrina | 12 ft. × 1 ft. 6 in |
| LABURNUM | Leguminosæ | Goodia latifolia | 3 ft. × 6 in. |
| LANCEWOOD | Rutaceæ | Eriostemon squameus | 20 ft. × 8 in. |
| LAUREL, NATIVE | Saxifrageæ | Anopterus glandulosus | 3 ft. × 6 in. |
| LEATHER-WOOD | „ | Eucryphia billardieri | 10 ft. × 1 ft. |
| MINT-TREE | Labiatæ | Prostanthera lasianthes | 3 ft. × 6 in. |
| MUSK | Compositæ | Olearia argophylla | 6 ft. × 1 ft. 6 i |
| NATIVE CHERRY | Santaleæ | Exocarpus cupressiformis | 6 ft. × 1 ft. |
| NATIVE CURRANT | Rubiaceæ | Coprosma microphylla | 3 ft. × 6 in. |
|  | Epacrideæ | Lupcopogon richei |  |
|  | Santaleæ | Leptomeria billardieri |  |
| „ PEAR | Proteaceæ | Hakea acicularis |  |
| „ PEPPER | Magnolieæ | Drimys aromatica | 6 ft. × 1 ft. |
| PINE, CELERY-TOP | Coniferæ | Phyllocladus rhomboidalis | 25 ft. × 1 ft. to |
| „ HUON | „ | Dacrydium franklinii | 30 ft. × 2 ft. to |
| „ KING WILLIAM | „ | Athrotaxis sleaginoides | 30 ft. × 1 ft. to |
| „ OYSTER BAY | „ | Frenela rhomboidea | 10 ft. × 6 in. to |
| PINKWOOD or ROSEWOOD | Euphorbiaceæ | Beyera viscosa | 12 ft. × 1 ft. |
| PRICKLY MIMOSA | Leguminosæ | Acacia diffusa | 4 ft. × 6 in. |
| SASSAFRAS | Monimiaceæ | Atherosperma moschata | 15 ft. × 1 ft. to |
| SCENTWOOD | Apocyneæ | Alyxia buxifolia | 3 ft. × 3 in. to |
| SHE-OAK | Casuarineæ | Casuarina quadrivalvis | 6 ft. × 1 ft. 6 i |
| SILVER WATTLE | Leguminosæ | Acacia dealbata | 12 ft. × 1 ft. 6 in |
| TEA-TREE | Myrtaceæ | Leptospermum lanigerum | 10 ft. × 6 in. |
| „ | „ | Kunzea corifolia | 10 ft. × 6 in. |
| „ | „ | Melaleuca gibbosa | 10 ft. × 6 in. |
| „ | „ | „ squarosa | 10 ft. × 1 ft. |
| „ | „ | „ ericæfolia | 20 ft. × 2 ft. |
| WARATAH | Proteaceæ | Telopea truncata | 3 ft. × 6 in. |
| WHITE WARATAH | „ | Agastachys odorata | 3 ft. × 6 in. |
| WHITEWOOD<br>TALLOW-WOOD | Pittosporeæ | Pittosporum bicolor | 6 ft. × 1 ft. |

## TIMBER TREES.—(A. O. Green.)

| Strength. $S=\frac{LW}{4bd^2}$ | Specific Gravity. Well seasoned. | Well seasoned samples weight per cubic ft. | Remarks as to use, &c. |
|---|---|---|---|
| | | lbs. | |
| 2712-2804 | ·62–·85 | 39-54 | General carpentry, cooper's work, furniture, 2 varieties, red and white. Plentiful. |
| .. | .. | .. | Turnery, inlaying, &c. Common. |
| 2050 | ·9 | 56 | Ornamental wood, with variety of colours. Common. |
| 2300-2744 | ·616 | 37–40 | A handsome joiner's and cabinet-maker's wood. Common. |
| .. | .. | .. | Tough, suitable for wooden hoops, &c. Common on coast. |
| .. | ·837 | 52 | Turners. Engraving blocks, &c. Common. [north. |
| .. | ·744 | 46 | Mathematical instruments, cabinet and turner's work. Common in |
| 2000-3500 | ·84–1·09 | 52–68 | Buildings, railways, bridges, furniture, &c. Plentiful. |
| 2400 | ·700 | 44 | Inside work. |
| 2400 | ·896 | 55–60 | Buildings, railways, bridges, furniture, &c. Plentiful. |
| 3300 | 1·001 | 63 | " " " " " |
| 2600 | ·75–1·039 | 46–65 | " " " " " |
| 2260 | 1·052 | 66 | " " " " " |
| 1800-3600 | ·77-1·05 | 48–66 | Most durable, suitable for all purposes. Plentiful. |
| 1600-2400 | ·776–·8 | 48–51 | Suitable for carpenters, joiners, house fittings, floors, &c. Plentiful. |
| 1400-3000 | ·776–·85 | 48–54 | Plentiful. Very strong wood for inside work. |
| .. | .. | .. | Common. Capentry and fencing. |
| 1646<br>1788 | ·7–.76 | 44–48 | For carpenters, joiners, house fittings, floors, &c. Plentiful. |
| .. | ·863 | 54 | Cabinet-maker's and ornamental work; bold figure. Common. |
| .. | ·675 | 42 | Cabinet-maker's and ornamental work. Common. |
| .. | ·700 | 44 | A tough elastic wood for implements, tools, &c. Common. |
| 3000 | ·875 | 58 | Pulleys and bearing blocks, similar to *lignum vitæ*. Common N.E. |
| .. | .. | .. | Turnery and inlaying. |
| .. | ·801 | 50 | Turnery and Implements. Common. |
| .. | .. | .. | Ornamental work. [Coast. |
| 3200 | ·7 | 42–44 | A light, tough, and elastic wood for implements, &c. Common West |
| .. | .. | .. | Ornamental work. |
| .. | ·675 | 42 | Handsome wood, for joiner's and cabinet-work. Common. |
| .. | ·790 | 49 | A-red brown wood for cabinet-work. Common. |
| .. | ·739 | 46 | Turnery and tools; handsome grain. Common. |
| .. | .. | .. | Turnery, &c. |
| .. | .. | .. | Common North and West. |
| 2800 | ·65–·7 | 41–44 | A dense, strong pine: general carpentry. Common N. and W. |
| 1218 | ·529 | 33 | Durable pine, often handsomely figured. Common W. Coast. |
| 1019 | ·336–·385 | 21–24 | Extremely light, strong, straight-grained. Common W. Coast. |
| .. | ·625 | 39 | A strong pine for framing, poles, &c.; very durable. Local, East |
| .. | ·75 | 47 | Tools, turnery, &c. [Coast. |
| .. | .. | .. | Ornamental and implements. [mon. |
| .. | ·652 | 41 | Plain, light-coloured, good for carving if felled in the winter. Com- |
| .. | .. | .. | A sweet-scented wood for sachets, &c. Local, North Coast. |
| .. | ·663 | 41 | A handsome, ornamental wood for cabinet-work. Common. |
| .. | ·775 | 48–49 | Straight-grained, elastic wood, of general utility. Common. |
| .. | ·801 | 50 | A tough wood for implements, tools, &c. Common. |
| .. | .. | .. | " " " " |
| .. | .. | .. | " " " " |
| .. | .. | .. | " " " " |
| .. | ·750 | 47 | " " " " |
| .. | .. | .. | Turnery and inlaying. |
| .. | ·652 | 41 | " |
| .. | ·801 | 50 | Engravers, &c. |

# BOTANICAL DESCRIPTIONS OF EUCALYPTI.

By L. RODWAY.

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*Eucalyptus globulus* (*Labillardiere*).—Tall, erect tree, even in exposed situations, tending to preserve a preponderating main-stem till the high forest age is reached, the branches few and acutely diverging; bark deciduous. Mature foliage alternate, stalked, lanceolate, acute, oblique, 6 to 12 inches long, 1 to 2 inches wide. Flowers solitary in the leaf axils. Outer operculum smooth, shed while the bud is approaching maturity; calyx and inner operculum rough, warted, and obscurely four-ribbed; mature calyx about ¾ inch in diameter; anther-cells parallel. Fruit broadly obconic, ¾ to 1 inch in diameter; capsule slightly protruding; valves obsolete. In Eastern Victoria the common form of this tree bears a three-flowered umbel in the axil, the flowers being half the size recorded in the type, and less warted. In Tasmania, where this species and *E. viminalis* are mixed, a form will occasionally be found consisting of odd trees in which the flowers are in threes, the operculum and fruit quite smooth, and the fruit about ⅓ to ½ inch in diameter, the valves much protruding. This, though very close to the Victorian form, may be a hybrid.

*Eucalyptus viminalis* (*Labillardiere*).—Very variable, rarely exceeding 50 to 70 feet; tending to diffuse branching. Bark usually smooth and deciduous, but sometimes scaly and persistent, even to the upper branches. Leaves oblique, lanceolate 2½ to 6 inches, narrow to broad. Flowers usually in threes, in the axils, seldom the umbel bearing many flowers. Operculum smooth, about as long as the calyx, dome-shaped to pointed; calyx smooth, obconic, about 2 to 4 lines long; anther-cells parallel. Fruit 3 to 5 lines diameter, hemispheric; valves of the capsule protruding.

*Eucalyptus coriacea* (*A. Cunningham*), *E. pauciflora* (*Sieber.*)—Attaining in favourable situations 60 to 70 feet; much branched, and rather spreading. Bark smooth, and deciduous from the base. Leaves alternate, oblique, lanceolate, and usually rather broad, 4 to 8 inches long, the primary veins bold, few, nearly as large as and nearly parallel with the midrib, giving the leaf a penninerved appearance. Flowers many, in axillary umbels. Operculum hemispheric, very short; calyx hemispheric, about 3 lines diameter; anther-cells diverging; stamens all or nearly all complete. Fruit pear-shaped, about 4 to 5 lines long; capsule sunk.

*Eucalyptus sieberiana* (*F. v. Müeller*).—A tree often attaining a considerable size, the main stem tending to predominate, but not as much so as in *E. globulus*. Bark persistent, thick, and furrowed to the branches. Leaves alternate, oblique, lanceolate, rather broad, 4-6 inches long; the veins not numerous, much smaller than the midrib, and coming off and travelling at a very acute angle. Flowers many, in axillary umbels, the common stalk much flattened; operculum very short, hemispheric. Calyx hemispheric, about 2 lines diameter; outer stamens without anthers; anthers with diverging cells. Fruit pear-shaped, capsule sunk, about 4 to 6 lines diameter.

*Eucalyptus hæmastoma* (*Smith*).—A tall, erect tree, the main stem preponderating; branches few and sub-erect. Bark smooth, deciduous, except fibrous towards the base. Leaves lanceolate, oblique, about 6 inches, veins few, obtuse, obscure, netting freely. Flowers many, in axillary axils, the common stalk rather long and flat. Operculum short, hemispheric; calyx hemispheric, about 2 lines diameter, on a relatively-long stalk. Outer stamens barren; anthers with divergent cells. Fruit broadly pear-shaped, 3 to 4 lines diameter, the rim broad and red, capsule nearly level; the valves usually protruding.

*Eucalyptus obliqua* (*L'Heritier*).—In shady situations, with a tall, preponderating stem, branches sub-erect; in the open, a medium-sized tree with spreading branches, and an undefined stem in the branching portion. Bark normally persistent, thick and fibrous to the upper branches; at an altitude the bark tends to become thinner and more deciduous, even to the base. Leaves 4 to 5 inches long, ovate, acute, oblique, very unequal-sided; veins few, freely netting. Flowers many, in axillary umbels; operculum very short, convex; calyx about 3 lines diameter, tapering into the stalk. Stamens all perfect; anthers with diverging cells. Fruit pear-shaped, about 4 lines diameter; capsule sunk.

*Eucalyptus regnans* (*F. v. Müeller*).—A tree attaining very large proportions, with a preponderating stem, except where grown in open lowlands. Bark thin; fibrous at the base, deciduous above. Leaves in the typical tree ovate-lanceolate, oblique, about 2 inches long, rather thick; veins few, obscure; in aberrant forms, the leaves are broad and very oblique. Flowers many, in axillary umbels. Operculum short and convex. Calyx obconic, about 2 lines diameter. Stamens all perfect; anther-cells diverging. Fruit turbinate, or sometimes approaching a pear-shape, about 2½ to 3 lines diameter.

*Eucalyptus amygdalina* (*Labillardiere*).—Most variable in stature, flowering when a small shrub, or attaining 100 feet or more; stem preponderating, except in some open situations, where the branches may spread. Bark thick, persistent, and fibrous in the typical form, deciduous and smooth from the base in some narrow-leaved forms, but not in others (*E. linearis, Denh.*). Leaves very variable, narrow lanceolate in the type, but varying from narrow linear to ovate; nearly equal-sided, veins few and obscure, 2 to 4 inches long. Flowers many, in axillary umbels: operculum short, convex; calyx hemispheric, mostly 2 lines diameter, sometimes more, anther-cells diverging. Fruit nearly hemispheric, rarely tending to pear-shaped, about 2½ lines diameter; capsule level with the rim, or slightly sunk.

*Eucalyptus müelleri* (*T. B. Moore*).—A tall, erect tree, with a preponderating stem, in suitable situations attaining even 200 feet height. Bark deciduous, smooth from the base. Leaves oblong, nearly or quite equal-sided, thick and shiny, alternate and stalked, 2 to 3 inches long. Flowers three together, in axillary umbels, the stalks all very short. Operculum short, hemispheric, and usually with a blunt central point. Calyx hemispheric, about 4 lines diameter; anther-cells parallel. Fruit turbinate (whiptop-like), about ½ inch diameter, valves usually protruding. This tree differs but slightly in structure from *E. vernicosa, Hooker*, and may be but a luxuriant form.

*Eucalyptus urnigera* (*Hooker*).—A tall, erect tree, with a preponderating stem. Bark smooth and deciduous. Leaves oblong, equal-sided, and about 2 to 3 inches long in sub-Alpine situations, but gradually becoming even linear and 6 to 9 inches long at a lower elevation. Flowers three together, in axillary umbels, the stalks and common stalks long. Operculum from very short and nearly flat to hemispheric and umbonate (centrally projecting); according to elevation. Calyx in sub-Alpine plant narrow ovate, and much constricted below the rim, about ½ inch long. Fruit similar in shape, but about ¾ inch long; the capsule much sunk. In lowland forms the fruit is sub-globose, and about ½ inch long, with the capsule slightly sunk; anther-cells parallel.

*Eucalyptus acervula* (*Hooker, not of Sieber*).—A medium-sized tree, with a strong tendency to branch, close to *E. gunnii*, and combined with it by *von Müeller* and some Continental botanists. Bark smooth above, coarsely scaly below. Leaves broadly oblong, thin, and rather shining, often undulated, equal or nearly equal sided, 2 to 4 inches long. Flowers many, in axillary umbels. Operculum hemispheric, with a well-developed apex. Calyx 2 to 3 lines diameter, hemispheric; anther-cells parallel. Fruit obconic, 3 to 4 lines diameter; capsule slightly sunk.

*Eucalyptus risdoni* (*Hooker.*)—A small to medium-sized tree, with a branching, often drooping, tendency. Leaves in the typical form apposite and connate, but often, without reference to size or locality, becoming, except where very young, alternate, stalked, oblique, narrow, ovate-lanceolate, few and obscurely veined, 2 to 6 inches long. Flowers many, in axillary umbels. Operculum very short, nearly flat, and rough. Calyx about 3 lines diameter, hemispheric; anther-cells diverging. Fruit hemispheric, or sometimes pear-shaped, about 4 lines diameter; capsule hardly or not at all sunk. Closely allied to *E. amygdalina* (*Labillardiere*), and combined with it by *von Müeller*.

This completes the list of *Eucalypts* that attain size enough to yield timber.

## LOCAL NAMES AND GENERAL APPEARANCE OF GUM TREES.

### Local Names.

**Blue-gum.**—*E. globulus* (*Labillardiere*).

**White-gum.**—*E. viminalis* (*Labillardiere*).—This is also called Manna-gum and Swamp-gum.

**Weeping-gum.**—*E. coriacea* (*A. Cunningham*).

**Iron-bark.**—*E. sieberiana* (*F. v. Müeller*).

**Gum-topped Stringy.**—*E. hœmastoma* (*Smith*). Also called White-topped Stringy.

**Stringy-bark.**—*E. obliqua* (*L'Heritier*).

**Swamp-gum.**—*E. regnans* (*F. v. Müeller*). Also known as Mountain Ash, Gum-topped Stringy, Peppermint-topped Stringy, &c.

**Black Peppermint.**—*E. amygdalina* (*Labillardiere*). This usually includes all Peppermints with stringy-bark.

**White Peppermint.**—*E. linearis* (*Dehnhart*). Peppermints with narrow leaves and smooth white bark, the persistent portion at the base scaly.

**Blue Peppermint.**—*E. risdoni var elata.* Also known as White-gum and Cabbage-gum.
**Red-gum.**—*E. acervula (Hooker).*
**Mountain Red-gum.**—*E. Müelleri (Moore).*
**Drooping-gum.**—*E. risdoni (Hooker).*
**Cider-gum.**—*E. gunnii (Hooker).*
**Mountain Peppermint.**—*E. coccifera.*
*E. urnigera (Hooker), E. cordata (Labillardiere),* and *E. vernicosa (Hooker),* have not yet received generally-accepted popular names, and will be referred to here as the Urn-bearing, Heart-leaved, and Dwarf-gum respectively.

*Blue-gum* is usually easily recognised in the forest by its erect habit, the stem, even in the branching portion, remaining distinct, and the branches few and erect. This habit is shared by few other species, and from those it may be distinguished by the character of the bark, which is scaly and never fibrous at the base, and above smooth, green to grey, and stripping off in long ribbons. *Stringy-bark,* on the other hand, except where close growth compels it, seldom acquires the same erect preponderating stem; the branching is more copious and spreading, and the bark in the typical forms persistent, and fibrous to the upper branches. In trees at a considerable elevation the bark is less persistent, and in many cases is shed from close to the base, but the base is still fibrous. The *Peppermints* vary greatly, and are primarily distinguished in the open by their small leaves; in critical cases reference will have to be made to the scientific description to avoid error. *Black Peppermint* has the erect habit, and a persistent, dark, fibrous bark to the upper branches, but forms are constantly met with where the persistent bark is not as copious. Stunted forms of this, which flower when merely shrubs, have a tendency for the bark to turn scaly. *White Peppermint* has a much more branching and spreading tendency, the bark white and smooth from the base, where the persistent bark is coarsely scaly. *Blue Peppermint* has the habit and bark of the last, but the leaves are much larger and broader, and the fruit larger; it is a connecting-link with *Drooping-gum,* which again has the same habit and bark, but the leaves are in pairs opposite one another, and *joined at the bases. Mountain Peppermint* is very similar to *Blue Peppermint,* but the leaves are still broader, and the fruit very much larger, and often three together, a feature not found in other *Peppermints. Swamp-gum* is the name given to a perfect series of forms connecting *Black Peppermint* with *Stringy-bark.* In the typical form the habit is that of *Blue-gum,* but the persistent bark, though thin, is fibrous, and continues a considerable distance up the stem; but in parts, however, the bark is deciduous from close to the base, and strips off above in ribbons, as in *Blue-gum,* leaving besides the more critical details merely the basal bark for identification. *Iron-bark* has the habit of a large *Stringy-bark,* but the persistent bark is nearly black, very thick, and coarsely furrowed. It occurs only on the North-Eastern portion of the State. *Gum-topped Stringy* is very similar to the latter, but tends to be more erect in habit, and the bark is less coarse and less persistent. It also is confined to the same locality. The name, when applied in other parts, refers to other species. *Weeping-gum* varies in habit, being erect, with a preponderating stem in damp forests, and much branched, spreading and drooping in the open. The bark is smooth from

**the base, and green to nearly white in colour. To distinguish it it is very necessary to examine the leaves, the parallel venation of which at once separates it from any form but *Iron-bark*.**

*White-gum* seldom exceeds the dimensions of a small tree, with a much branched and spreading habit—the main stem soon lost in branches. The bark varies in deciduousness, is sometimes smooth and white from the base, sometimes persistent to the upper branches; this persistent bark is never fibrous, but more or less scaly. The leaves of this tree are most variable; they run from the shape and size of a typical *Blue-gum* to small and narrow-linear, as in narrow-leaved *Peppermints*. Reference is already made in the botanic description of *Eucalyptus globulus* to the probable hybridisation with this species.

The *Cider-gum* of the Midlands and Lake Country is more of the character of a large bush, seldom exceeding 20 feet. The bark is smooth and white from the base; some forms have, when young, large round leaves opposite in pairs, and joined at the base, but this seldom continues long after the flowering period is reached. The leaves of this Gum are not oblique, but equal-sided, and the flowers are always three together.

*Red-gum* is very closely allied to the last, and in Australia is often considered but a form of it. It is a small to medium sized tree, much branched and spreading. The bark is persistent more or less up the stem, and is coarsely scaly. The leaves are equal-sided, shining, and often undulated on the margin. The flowers usually six to eight together. The name *Red-gum* has merely a local significance, as it has no relationship to the various Red-gums of Australia.

*Mountain Red-gum* is a different tree altogether; it has a tendency to a tall central stem, but is much influenced by surroundings, attaining a height of 150 feet in some parts, dwindling down to a mere shrub in others. The bark is smooth from the base, green, blotched with red-brown. *Dwarf-gum* is very close to this in form of organs, but appears to maintain a distinct character. It seldom exceeds 3 to 5 feet in height. Leaves are small, nearly round, opposite but stalked, equal-sided, thick, and shiny. The flowers are solitary or three together. It appears to occur only on the sub-alpine plains of the West and South-West.

The *Urn-bearing gum*, at an altitude of about 2000 feet, is exactly similar to the *Mountain Red-gum* in general appearance, both of habit, bark, and foliage, but the fruit is shaped like a Grecian urn. Below this altitude the bark becomes ashy-white, the leaves long and narrow, and the fruit approaches the fruit of *White-gum*. The *Heart-leaved gum* is a small, erect tree, with a smooth bark, the old bark being shed in scales. The leaves are pale and opposite in pairs, but, unlike those of *Drooping-gum*, are not united by their bases.

L. RODWAY.

# NOTES ON TASMANIAN CONCHOLOGY.

By C. Hedley, F.L.S.

(Read June 10th, 1902.)

(Issued June 17th, 1902.)

(*Plate.*)

The study of Tasmanian conchology has been facilitated by an excellent catalogue published last year by the late Prof. Tate and Mr. W. L. May in the Proceedings of the Linnean Society of New South Wales. Therein certain species ascribed to Tasmania by the Rev. J. E. Tenison Woods were rejected from the fauna chiefly because no later observer had taken them. Though apparently of foreign origin, their exclusion could not be wholly justified until that origin was ascertained. At the invitation of Messrs. A. Morton and W. L. May I undertook their examination. From the result it appears that five West Indian species were supplied to Tenison Woods, which he erroneously described as Tasmanian, and as new to science. They are :—

Pleurotoma weldiana, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 137, identical with *Drillia fucata*, Reeve, Conch. Icon. Pl. xx., f. 169.

Ethalia tasmanica, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 146, is the common West Indian *Modulus modulus*, Linne.

Adeorbis picta, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 146, is *Chlorostoma fasciatus*. Born, Woods's type answers well to fig. 2a of Pl. 63 of Fisher's Monograph in the "Coquilles Vivantes."

Astele turbinata, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 145, is *Chlorostoma scalare*, Anton, another well-known West Indian shell.

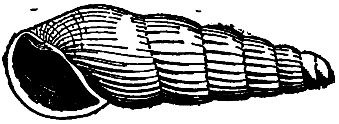
Semele warburtoni, T. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 158, is *Codakia orbicularis*, Linne; a common Antillean species

An examination of the type of *Turbo cucullata*, Ten. Woods, Proc. Roy. Soc. Tas, 1877 (1879), p. 121, shows it to be *T. radiatus*, Gmelin; a shell common to tropical Queensland. Another unrecorded synonym of this appears to be *T. pallidus*, Perry, Conchology, 1811, Pl. 49, f. 5.

Having inspected the type of *Chione macleayna*, T. Woods, Proc. Roy. Soc. Tas., 1879, p. 38, I consider it identical with *C. stutchburyi*, Gray; a common New Zealand species, and therefore probably not Tasmanian.

Allportia expansa, Ten. Woods, Proc. Roy. Soc., Tas., 1876 (1877), p. 28. At my request Miss Lodder sent me some examples of this species. The material received corresponded exactly to Wood's description, and was, I believe, rightly identified. It is certainly not a mollusc, but a planarian. My friend, Mr. T. Whitelegge, considered that it is probably *Polycelis australis*, Schmarda. It had better be excluded from the molluscan catalogue.

The existence of the order Heteropoda in Tasmanian waters has been overlooked by Tate and May. The occurrence in Bass Straits of a species of FIROBOIDA is noted by Macdonald. Trans. Roy. Soc., Edinburgh, xxiii., 1862, p. 5, pl. i., ff. 1-4.



RISSOINA GERTRUDIS, Ten. Woods, Pro. Roy. Soc., 1876, p. 146. This species approaches *R. elegantula*, Angas; whether or not intermediate forms unite these two, I leave to the decision of those better acquainted with the species. The illustration published by Tryon is very bad; possibly it was based on a different species. I add a drawing of the type specimen in the Tasmanian Museum.

CYCLOSTREMA WELDII, T. Woods. It is generally admitted that this and C. *australe*, Angas are synonymus. Tate and May regard the latter as having priority, but Pritchard and Gatliff award it to *C. weldii*. As a matter of fact, *C. weldii* was published Feb. 27th, 1877, and *C. australe* on June 1st, 1877.

TROCHUS RINGENS, Menke Fischer, in the Coquille Vivantes, Troque, 1879, p. 214, notes this species from "Ile Van Diemen." It is not included in any Tasmanian catalogue.

# NOTE ON *EUCALYPTUS LINEARIS*, DEHNHARDT.

(A Supposed Tasmanian Species.)

By J. H. Maiden, Director Botanic Gardens, Sydney,
Corresponding Member.

(Read July 8th, 1902.)
(Issued July 23rd, 1902.)

In a paper entitled "The Common Eucalyptus Flora of Tasmania and New South Wales," read by me before the Australasian Association for the Advancement of Science at its Hobart meeting last January, I drew attention to a small smooth-barked Mount Wellington tree, closely related to *Eucalyptus amygdalina*, Labill., and considered to be *E. linearis*, Dehnhardt.

I have recently received for study, from the Imperial Natural History Museum of Vienna, a type specimen of Dehnhardt's species, which is, however, in bud only. The original label in Dehnhardt's handwriting is in German, of which the following is a translation:—

"I pray you read my description in the Catalogue. The tree is 40ft. high, with a slender stem, and flowers the second time."

The reference to the "Catalogue" is doubtless to the "Catalogus plantarum horti Camaldulensis," which contains the description of the species, and which I have given in full in my paper already referred to. The work in question was published at Naples, and I understand the Hortus Camaldulensis was a garden near that city. The first edition was published in 1829, and the second in 1832, and should be noted in case any claims for priority arise.

Dehnhardt's plant is, without doubt, a cultivated one, and bearing in mind the marked way in which seedling Eucalyptus plants differ from their parents, it is not likely to be absolutely identical with the Mount Wellington plants to which it has been referred. The idea becomes stronger with me that *E. linearis*, Dehn., will prove to be a perfectly smooth-barked form of *E. amygdalina*, with unusually thin, linear leaves. If so, this form of *E. amygdalina* might be named var. *linearis*.

My researches in European herbaria in regard to this genus has brought to light another named species which is con-specific with *E. linearis*. It is *E. pulchella*, Desfontaines.

The original work not being in any Australian library, I obtained a copy of the description from Kew. It is as follows:—

"*Eucalyptus pulchella*, Desf. Ramulis filiformibus; foliis alternis, lineari-subulatis: floribus axillaribus, umbellatis, operculo convexo, mucrone obtuso, brevissimo.

"Ramuli filiformes, paniculati. Folia uncias 2 longa, lineam 1 lata, utrinque acuta. Petioli breves. Flores in umbellulas axillares dispositi. Pedunculus communis folio multoties brevior, 10-12—florus."

*(Cat. Hort. Paris.* Ed. 3, 408, 1829.)

Dehnhardt contracts this description into:—

"*Eucalyptus pulchella.* Ramulis filiformibus; foliis alternis lineari-subulatis. Ramulis filiformibus panicularis. Folia uncias 2 longa, lineam 1 lata."

(Dehnh. *Cat. Pl. Hort. Camald.* Ed. 2, p. 20.*)

Walpers' description, published in 1845, is also adapted from the original, and is as follows:—

"Ramulis filiformib. foll. alternis lineari-subulatis, florib. axillarib. umbellatis; operculo convexo, mucrone obtuso brevissimo.—Crescit——— ?"

(Walpers' *Repert.* III. 927.)

Bentham perhaps saw the species, but he pronounces it to be "very doubtful"

I have recently received some specimens from the Vienna Herbarium labelled "*E. pulchella*, Hort., Kew." They are in bud, and are identical with *E. linearis*, Dehn.

Undoubtedly the name *pulchella* was well bestowed, for the specimens have especially long, narrow, linear leaves, which are very graceful.

The upshot of my investigation is that:—

*E. linearis*, Dehnhardt, and *E. pulchella*, Desfontaines, are specifically identical. Both were named from plants raised in Europe. In my Australasian Association for the Advancement of Science paper I have put forth a plea for a final investigation by Tasmanian botanists as to whether a certain Mount Wellington tree is identical with *E. linearis*, Dehnh., and, if so, whether it is con-specific with *E. amygdalina*, Labill.

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* In my A.A.A.S. paper I quote *E. pulchella*, and also *E. rubricaulis*, as they follow Dehnhardt's description of *E. linearis*. My identification of *E. pulchella* is given below. I have also seen *E. rubricaulis*, Desf., which is not identical with *E. linearis*, and may not be a Eucalyptus at all.

# NOTES ON SOME REMARKABLE TASMANIAN INVERTEBRATES.

By ARTHUR M. LEA, F.E.S., ETC.

(Read July 8th, 1902.)

(Issued July 23rd, 1902.)

(*Plate.*)

Under the above heading I propose from time to time to give notes on some remarkable Tasmanian insects, and probably other invertebrate forms of life. The notes, whenever possible, will be illustrated with sketches. The present deals with one of the walking-stick insects, being the first record of the occurrence of this remarkable family (*Phasmidæ*) in Tasmania.

### *Acrophylla tasmaniensis*, n. sp.

Of a dingy, testaceous brown; wings black, costal area on its basal half variegated with yellow and black, the outer half testaceous brown. Antennæ very finely pubescent.

Head without granules, anterior half wrinkled; ocelli absent. Antennæ thin, joints 23 in number, first the length of second and third combined, second slightly more than half the length of third, terminal joint almost the length of the three preceding combined. Prothorax not quite as long as head, surface wrinkled, and with a few very small granules. Mesothorax more than twice the length of prothorax and head combined, with small scattered spines. Tegmina nearly three times as long as wide, apex rounded, concealing about half the length of the folded wings. Wings about once and one-half as long as wide, the costal area about one-third of the whole. Abdomen about two-thirds of the total length of body, fifth segment inflated on each side posteriorly, sixth raised in middle of base; anal styles long, parallel-sided, somewhat wavy, apex rounded. Meso- and metasternum with a few small granules; ovipositor longer than three apical segments. Legs long and thin, anterior femora serrate, the others with small spines, of which the largest are on the middle of the upper surface; tibiæ feebly spinose (the anterior almost bare of spines), the intermediate each with a large tooth on the upper surface before the middle.

Lengths in millimetres:—Head, 8 [*5½]; prothorax, 7 [5]; mesothorax, 31 [19]; metathorax, 16 [13]; abdomen (exclusive of anal styles), 89 [54]; antennæ, 26 [11½]; anal styles, 20 [8]; anterior femora, 39 [23], tibiæ, 42 [26], tarsi, 16 [11]; intermediate femora, 28 [18], tibiæ, 30 [18], tarsi 13 [8½]; posterior femora, 34 [20], tibiæ, 38 [22], tarsi, 15 [10]; tegmina, 19 [2½]; wings, 20 [3]; total length (including anal styles), 170† [102].

Habitat, Burnie.

(Presented to the Tasmanian Museum by Miss Dora Shoobridge.)

The specimen (a female) appears to be somewhat discoloured, as there are traces of green on the mesothorax under surface of tegmina and anal styles; the ovipositor is also somewhat damaged. The large tooth of the intermediate tibiæ is single on the left, but double on the right.

The species appears to be allied to *A. chronus* (Westwood, Catalogue of Phasmidæ, p. 114, supplementary plate V., fig. 2), but should be distinct on account of the posteriorly inflated fourth abdominal segment and large teeth of the intermediate tibiæ. From Westwood's figure it differs in the shape of the tegmina and length of wings; the latter, however, are described as being very variable in length. The colours of the wings are very different to those given for *chronus*, the membranous portion being entirely black, whilst in the figure it is drawn (and also so described) as being variegated. The serrations and spines of the legs are also very different to those on Westwood's figure.

An immature specimen, evidently belonging to this species, was presented to the Department of Agriculture by Mr. W. C. Weymouth. Its antennæ consist of but 24 joints each. The spines and serrations of the legs are the same as in the type, even to the peculiar dentition of the intermediate tibiæ. The tegmina and wings are very small, of almost equal size and shape, and of a dull greenish yellow, with thickened edges, they look like scales. The general colour of the body is rather paler than that of the type.

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* The lengths given in brackets are those of the immature specimen.

† It is, therefore, the longest (although not the largest) insect at present known to occur in Tasmania.

# NOTE ON A SPECIES OF EUCALYPTUS NEW TO TASMANIA.

By J. H. Maiden, F.L.S. (Corr. Member),

Director, Botanical Gardens, Sydney.

(*Read September 8th,* 1902.)

(Issued September 10th, 1902.)

*Eucalyptus Macarthuri,* Deane and Maiden, between Deloraine and Chudleigh Junction, January, 1902.

Swanport, Dr. Story (labelled *E. Stuartiana,* by Mueller).

For an account of this species see Proc. Linn. Soc. N.S.W., 1899, 448, with figure. Its discovery in Tasmania was the outcome of the Australian Association for the Advancement of Science Meeting at Hobart, and came about in the following way:—Mr. R. H. Cambage, L.S., of Sydney, was travelling in the train between Deloraine and Chudleigh Junction when he espied a rather umbrageous tree, with fibrous bark up to the branchlets, in grassy flats or depressions, which become filled up with water during the wet weather, on the right bank of the Meander River. From its situation and habit of growth he considered it might be *E. Macarthuri,* which he had seen in New South Wales. When he came to the above meeting at Hobart he communicated to me his suspicions, and as it was impossible for him to examine the tree personally, I made a special journey to Deloraine, found the tree in question, and obtained specimens, which proved the species to be E. *Macarthuri,* Deane and Maiden. I have since seen specimens in the Melbourne Herbarium, collected by the late Dr. Story at Swanport, Oyster Bay, Tasmania, and referred to by Mueller at the time to be *E. Stuartiana.* Further inquiry will doubtless greatly extend the range of the species, which will probably be found in Victoria also ere long.

We thus add an additional Eucalyptus species to the flora of Tasmania, which now stands at 18, since in my paper on "The common Eucalyptus flora of Tasmania and New South Wales," read at the Hobart meeting, I produced evidence that the number stood at 17.

This species of Eucalyptus promises to have commercial importance through the researches of Mr. H. G. Smith, who has shown that its oil contains geranyl acetate in large quantities, which oil, when rectified, has a delicious odour of roses, which is remarkable in the genus. As I do not know the extent to which this interesting species occurs in Tasmania, it will be desirable for oil distillers not to fell the trees, but to lop the branches only.

A. De Candolle, in his Prodromus, iii., 218, described a plant under the name of *Eucalyptus pilularis*, Smith, which is not that species. The plant must be referred to as *E. pilularis*, A. DC., and following is a translation of his description:—

"Operculum conical, with a rather shorter calyx tube, the peduncles very short and subangular, flowers 6 or 7 in the head, leaves linear-lanceolate acuminate, with the veins confluent at the tops into an intramarginal one. New Holland, Sieber, plant exs. nov. holl. No. 474. I doubt whether this specimen of Sieber's that I have described is Smith's species or not? Is Sprengel's species different by reason of its corymbose inflorescence? Our flower-buds, the size of a grain of millet, peduncles 2 or 3 lines, nearly one half shorter than the petioles. Leaves 3 inches long and 5 lines broad."

It will be thus seen that the plant is Sieber's No. 474, an original specimen of which I have been able to examine from two sources (*a*) The Berlin Herbarium; (*b*) The Barbey-Boissier Herbarium at Geneva. The first specimen is in bud only, and the second is in bud and fruit. It turns out to be *E. Macarthuri*, Deane and Maiden, and thus the identity of a puzzling plant has been set at rest. Sieber's No. 474 is in Bentham's Flora Australiensis, iii., 240, referred to *E. viminalis*, Labill: which is a mistake.

This erroneous reference to *E. viminalis* reminds me to warn collectors that some small fruited multiflowered forms of *E. Gunnii* (*e.g.*, vars: *acervula, maculosa,* and perhaps *rubida*) may, in the absence of notes on the bark and suckers, be referred to *E. Macarthuri.*

# PRACTICAL ASTRONOMY IN TASMANIA, AND A PROPOSAL FOR A SCHOOL THEREOF. •

By Professor Alex. McAulay, M.A.

(*Read September 8th,* 1902.)

The leading English scientific newspaper "Nature," dated 24th July, 1902 (p. 304), has a paragraph on the present condition of meteorology in Australia. It is worth reading:—

> "We understand from recent Queensland newspapers that it has been determined to abolish the Weather Bureau of that colony as from the 30th ult., and that the services of Mr. C. L. Wragge and his special staff have been dispensed with. In a letter addressed by the Premier of Queensland to the Federal Prime Minister it is pointed out that this apparently retrograde step is owing to the urgent necessity for reducing in every branch of the public service the estimates of expenditure of the State, and that it is one of the "most unfortunate" results of the large deficit in the revenue brought about by drought and other causes. Prior to federation, the Weather Bureau formed part of the Post and Telegraph Department of Queensland, and all telegrams and correspondence passed free. But during the last fifteen months the Federal Government has charged for these communications at the rate of about £4,000 a year, which expense cannot be borne any longer by the Queensland Government. The Premier writes that he feels sure the States in general will welcome any reasonable suggestions for a continuance of the work of the Bureau under federal control. We may, therefore, hope that the existing instruments and stations will be utilised, as far as practicable, in the interest of meteorological science. Truly the Colonies are in this respect following the mother country, and we may soon expect the Empire, so active in neglecting science, to be the laughing stock of civilised peoples."

Our meteorological service has been, as you all know, closely connected with the Queensland one, to the advantage of both.

Apparently it is the federation of the States that has brought about the disastrous check to what is both a commercial and scientific work in this part of the world, and I think you will all agree that it is the Federal Government which is responsible for helping the various States back to their original efficiency in these matters.

I leave to others the task of defending the utility of meteorological observations, and will immediately proceed to my more special theme; but, before dismissing meteorology, I would like to remind any who may hear or read this paper that *continuity* in meteorological records is essential for their full utility, and it is pennywise and pound foolish to establish such records for a time, then discontinue them, and later undertake them once more.

The meteorological service in this State, as in many other parts of the world, is performed by the same staff as the astronomical service, and it is of this last I wish to speak in full.

I shall not hesitate to repeat what I have already said to the Society two months ago, partly because it refers to a matter that I think the public should, for its own benefit, take seriously to heart, and partly in order to make the present paper complete.

I propose to consider our subject under the following heads:—

(1) Practical astronomy of Tasmania in the past.

(2) The uses and desirabilties of practical astronomy in such a community as ours.

(3) The present.

(4) Proposals as to the future.

## I.

## PRACTICAL ASTRONOMY OF TASMANIA IN THE PAST.

With regard to the past I propose to say very little, though it would be interesting if somebody could be induced to look thoroughly through the proceedings of this Society and elsewhere to make a proper history of the subject.

Mr. Kingsmill two months ago gave you some account of the official work for the Government performed in the past. I would like to call attention to the other practical astronomical work that has been done here.

We have had two enthusiastic astronomers in our midst, who performed their work merely for the love of it, true amateurs, in the highest sense of the word—Mr. Abbott (died 1883) and Mr. Biggs (died 1901). Each of these had a private observatory, furnished with very fair instruments, and each did useful work. I am sorry to say that, as far as I know, there is no such amateur, with the necessary instruments in the State to-day.

It is of interest to know that what are, I believe, the two most valuable instruments which belonged to those two observers are likely now, after a number of years of idleness, to be put again to useful work.

The transit instrument of Mr. Abbott has recently been acquired by the University by purchase. It has been housed and nearly completely repaired. Its various adjustments in its new home have just been commenced by the students of the University. It is a larger instrument than the Observatory possesses, and it is probable that its performance will be found correspondingly more accurate.

I may say for the benefit of those of my hearers who are not conversant with the technical terms of Astronomy that the chief object of a transit instrument (other than one of the first class, which has additional uses) is to obtain the true time as accurately as it can be obtained. No other instrument is nearly so accurate for this purpose, and the time in all the States of Australia is at present obtained by means of transit instruments.

Mr. Biggs' equatorial telescope was left by him as a bequest to the Royal Society. The Royal Society has recently offered it on loan to the University, and it is at present stored at the University, though not in such a way as to be capable of use. The University has not yet signified its acceptance of the loan, probably because an expense of some £60 will be necessary to house, mount, and repair it. This telescope is an 8¼-inch reflector (Newtonian), and is, therefore, much superior to the equatorial at the Observatory.

It is much to be hoped that the University will see its way to accepting the offer, and so secure (let us hope for all time) the benefit to students of observing the wonders of the Heavens, after listening to the dry-as-dust description of them in the lecture room. It is to be remarked also that the students may be expected, with such an opportunity, to add to the knowledge of the human race,and this is no little reason why the offer should be accepted.

I look forward to the time when an Astronomical School of renown shall be firmly established here. Our opportunities in the matter of position are great. Let us not neglect them for petty passing reasons.

While considering practical astronomy in Tasmania in the past, we ought not to omit a reference to the transit of Venus in 1874. The main interests of that transit were, of course, world-wide, but Tasmania (did she but know it) has herself benefited by the visually insignificant fact that in 1874 Venus passed between the earth and the sun, and there fore was visible as a dot on the sun's face. Tasmania's gain is owing to the fact that on account of her valuable position in the far south, in this matter of finding the sun's distance, as in many other astronomical respects, she was at once seen to be a place where the necessary astronomical observations ought certainly to be made. But the Astronomer Royal of England said "No," for we do not know her longitude sufficiently accurately—and that was true, we *did* not. America came to the rescue. "Why not," said America, "find the longitude accurately?" So they came, found the longitude, observed the transit, and went.

I will not preach here of the importance of knowing the longitude. I will only say that it is a very complicated matter to obtain it, a matter requiring costly instruments, much knowledge, and much painful training, and the result is that we know where we are on this planet.

The result with regard to longitude is that for all time we know the following fact:—We know that a certain piece of masonry (at present in existence in the Barrack Square) is 9m. 25.66s. east of the centre of the transit instrument in Melbourne. The Melbourne longitude is itself in doubt, and I will now read you an extract from a letter I have received from Mr. Baracchi, the Victorian Government Astronomer, on that point:—

> "(1st) The present adopted longitudes of Sydney and Melbourne are:—Sydney, 10h. 4m. 49.44s.; Melbourne, 9h. 39m. 54.00s.
>
> "The Nautical Almanac still persists in giving the values adopted by Ellery Russell, and Todd, in their longitude report of 1886. I suppose, as the differences are small, and the values by no means final, it is considered unnecessary to introduce changes at present. In the American Ephemeris the value 9h. 39m. 54.00s. is adopted for Melbourne, and 10h. 4m. 49.54s. for Sydney.
>
> "When it will be time to introduce changes in our longitudes, my values of 1895 (Report A.A.A.S., 1895, pp. 185-208) will have to be further reduced, owing to the smaller values obtained for Madras later. I adopted for Madras 5h. 20m. 59.275s. The new and latest determination, gives 5h. 20m. 59.113s. Adding this to former results, with double weight, we obtain 5h. 20m. 59.167s., which, in my opinion is, at present, the best available value for the longitude of Madras, and, as no further measures have been made east of Madras since 1888, the longitudes of Sydney and Melbourne may be considered to be—Sydney, 10h. 4m.

49.33s.; Melbourne, 9h. 39m. 53.93s. (0.04s. was dropped arbitrarily when Zone time was introduced, simply for convenience).

"But I have no intention of altering our longitude at present, for two reasons—(1st) Because the values are by no means final. (2nd) Because there will be probably soon, an opportunity for fresh independent determinations of Australian longitudes via America, and via Cape of Good Hope, through Cocos Island.

"(2nd). The uncertainty of the present longitudes.—On the strength of the new Madras value, I think that the values—Sydney, 10h. 4m. 49.33s.; Melbourne, 9h. 39m. 53.93s.; Hobart, 9h. 49m. 19.59s.; are within 0.7s. for Melbourne and Sydney, and within 0.8s. for Hobart.

"(3rd). The true value of Harkness' position relative to Melbourne.—This value is 9m. 25.66s. (This is the only available value). [Harkness was the chief of the American 1874 transit of Venus Expedition to Tasmania.]

"(4th). Harkness' position.—This is his transit pier."

The piece of masonry in question is really very precious to Tasmania. If she allows it to become undecipherable, she will be put to much expense and much trouble once more to determine her longitude.

Commander Pury-Cust some time ago recommended that this piece of masonry should be suitably inscribed with the record of its meaning. This could be done at a trifling cost, and I believe will be done, but in case there should be hesitation on the part of the public or Ministry, I now make the necessary appeal. The only reason that the Premier has not yet been informed (for he has not) what to put upon the stone is that his advisers (Mr. Kingsmill and myself) have not yet found exactly what the record ought to be.

Mr. McDonald, of the Observatory, first informed me of the special nature of the observations, which were made by the American Transit of Venus Expedition, and led me to recognise the meaning of the three marks left by them in the Barrack Square. He has also lent those stereoscopic photographs of the instruments and position used, which are now in your hands. I should like to enter into more detail about the transit operations, but I have not time.

Two students of the University (Mr. McDonald and Mr. Kay) have lately found by surveying with instruments lent by Mr. Walker (an old student and present graduate) that the Harkness position and the present Observatory are situated relatively thus:—

Present Hobart Observatory relative to the transit of Venus (transit instrument) pier.

Lat. 3.61″ S., Lon. 0.051 s. W.

The present (1902) revised position of our Observatory is therefore

Lat. 42° 53′ 28.2″ S., Lon. 9h. 49m. 19.54 s. E.,

whereas in recent years the adopted values have been

Lat. 42° 53′ 28.3″ S., Lon. 9h. 49min. 19.76 s. E

## II.

## THE USES AND DESIRABILITIES OF PRACTICAL ASTRONOMY IN SUCH A COMMUNITY AS OURS.

I will now repeat and correct my remarks of two months ago. I said then that the keeping of time was so necessary for an island State such as Tasmania that it was imperative to know the time as accurately as possible. This I still believe. I also said (in the deputation of this Society to the Premier) that a first-class Observatory kept time to 1/100 of a second. This I said in ignorance. It is not so. Of this, more directly.

It is imperative to know the time as accurately as possible for this reason: Mariners depend upon the time for their position. I could say how they know their position North or South of the Equator by direct observations with the sextant, but this would occupy too much time, and I will only speak of how they determine their position East or West of some ascertained spot. They do this by means of their chronometers and sextant observations. If ocean mariners had a say in colonial politics, they would undoubtedly say, "Please give us time correctly; chronometers are excellent in their way, but their indications depend ultimately on observations of the stars, and these observations can only be properly carried out at fixed Observatories."

The rate of chronometers at sea is of the utmost importance, not only to mariners, but to the general public who travel by sea, for an error in the rate of one second in two days may mean an error of ten seconds in 20 days, and an error of 10s. in the chronometer may mean nearly three statute miles' error in position.

Is Tasmania a place where time should be kept accurately? I have no hesitation in answering "Yes." Tasmania has a port where steamers from South Africa call on their way to distant ports; other steamers call which are destined for a long voyage (say, starting from Sydney), after staying for a time at Hobart. It is absolutely necessary that we should be able to give them the same time as they received in Sydney, for if they receive it from us, they can ascertain their chronometers' rates at sea, and they cannot obtain these rates otherwise.

I have said before, and I say again, that it is in extreme cases sometimes necessary to know the time to one second, in order to make the necessary provision that means all the difference between life and death to many souls.

With regard to this question of keeping time, I again quote from Mr. Baracchi's letter, and you will see that I was wrong in saying that in a first-class observatory an accuracy of 1/100 of a second was attainable:—

> "(5th). Whether an accuracy of ν.01s. is attained in time keeping at this Observatory.—In time determinations, we aim at an accuracy of 0.01s., but I do not think we attain it often. I can't say whether we ever attain it. Under the best conditions in regard to atmosphere, instrument and observer, with a complete set of observations, viz., from six to ten standard clock stars, and from two to four azimuth stars, the clock error at the middle time of the observations can be determined probably within 0.03s.; greater accuracy is possibly attained on occasions, but is uncertain. Changes in personal equation are the disturbing causes.
>
> "In ordinary time-keeping, viz., dropping of time signal at 1 p.m., and rating chronometers for the shipping, in all of which cases we *have* to *rely* on the rate of the standard clock for several hours, the uncertainty is much greater and the limit of accuracy that we can depend upon with safety is 0.1s."

I should also here like to read a quotation from Mr. Morton's paper in the Papers and Proceedings of the Royal Society for 1900-1901 (p. 122), and another from the paper by Mr. Abbott, to which Mr. Morton's paper directed me:—

> "In May, 1865, the attention of the Society was directed to the necessity of some method of establishing a time signal which should give the time regularly, so as to be available for the whole of Tasmania. The first duty of fixing a time signal was soon after undertaken by Colonel Chesney, who arranged for three guns to be fired at 4 p.m. on the first Thursday in every month, or, if that day proved wet, they were fired on the first fine day following."

[Quotations from "Time Signals," by Abbott, May, 1865, p. 45.]

That it is highly desirable in the interests of science to establish a practical School of Astronomy in Tasmania is illustrated by the discussions which arose in connection with the Leake Bequest. The whole of those discussions have a most direct bearing on our present position. The Leake Bequest of £10,000 purported to establish a School of Astronomy, but, unfortunately, the money proved not available for that purpose. At the same time, the possibilities led to a discussion of the suitability of Hobart for astronomical work, and I will now read extracts from the proceedings of the Royal Society of 1892:—

[Quotations from "Leake School of Astronomy," by Russell, p. 26, and from letter by Waterhouse, p. xiv.]

## III.

## PRACTICAL ASTRONOMY IN THE PRESENT.

Practical astronomy in Tasmania in the present, I am sorry to say, consists solely of what the Government is prepared to believe is useful; that is to say, it consists of keeping time for the whole island by the transit instrument at the Observatory. As accurate time is kept as it is possible to keep by such means, and it is telegraphed every day to very many points in Tasmania automatically from the Observatory clock. The ball—that is, the mariners' signal—is not, but undoubtedly should be, dropped automatically. There is no standard clock in the Observatory, and the public of Tasmania depends on the charity of two private citizens for their clock service.

Not even surveyors (unless lately) make practical astronomical observations in order to determine their meridian. I remember some years ago being rather surprised at a well known surveyor's evident delight in finding a new (to him) and very accurate (compared with his old compass method) means of determining his meridian. This struck me, and still strikes me as something pathetic. I cannot help thinking that if we would allow ourselves a little more outside enlightenment, we might save ourselves a great deal of expense and worry, if only in litigation.

## IV.

## PROPOSALS CONCERNING PRACTICAL ASTRONOMY IN THE FUTURE.

In what I have now to say, I would ask you to remember Mr. Russell's remarks in connection with the Leake Bequest, which you have just heard. The advantages of combining the teaching of practical astronomy to students with observing are there properly emphasised.

Probably, if what I have now to propose should be adopted, such a School of Astronomy as Mr. Russell anticipated, would grow up, even without the inestimable advantage of a bequest of £10,000, and such a school would be a great benefit to the whole of Australia.

The Meteorological Department is over-worked, undermanned, and under-paid. It is inevitable that under these conditions some of its work is not as efficiently performed as it would be were its resources adequate.

My proposal is that that department be relieved of the astronomical work, but let it be most clearly understood that I, for one, will not counsel any such re-arrangement of duties if a single penny be as a consequence diverted from the Meteorological Department.

I propose that, leaving the pecuniary position of the department precisely as it is at the present, the whole astronomical work be forthwith handed over to the University. It may be asked how this is to be done, since the University finds difficulty in performing its present duties efficiently.

I will now make certain definite suggestions for the effecting of this scheme. The suggestions are definite, rather because I want a practical discussion here and elsewhere to be raised, than because of their intrinsic merit.

Let those who are competent pull the suggestions to pieces as much as they like, so long as the main object is kept in view, namely, the high desirability of laying the foundation of a really valuable School of Astronomy in Tasmania. Such a school (there are many in the United States) would be a benefit and a credit to the whole of the Commonwealth, and it would also be a benefit to the world at large.

I would submit then to your consideration the following suggestions:—

(a) No funds to be diverted from the Meteorological Department.

(b) The Meteorological Headquarters to remain in the Barrack Square, as at present, even if the Square be altered, as lately suggested by the Minister of Lands.

(c) The Government astronomical work to be handed over to the University on certain conditions.

(d) All the astronomical instruments to be transferred to the University grounds, and re-erected there, at the cost of the Government.

(e) Loan of the Transit Instrument in the possession of the Melbourne Observatory, which for many years was lent to Adelaide, to be asked for.

(f) Automatic connection between the Observatory clock and the time ball to be established by Government.
(g) Proper clocks to be provided by the Government.
(h) The University to grant site of new Observatory, and site of a residence for a new officer.
(i) The new officer to have the following duties:—
    (a) Observing time for the island.
    (b) Teaching in the University, astronomy, surveying, practical physics, and such parts of the mining course as it is possible and desirable for him to do.
(j) The salary of the new officer to be £350 a year, of which the Government provide £150 and the University £200.

(N.B.—The Observer would have to reside at the University. He might perhaps live in the house at present occupied by Professor Williams. If he lived rent free, the University's contribution to his salary should perhaps be only £175.)

In conclusion, let me say that the University is faced with the unpleasant reality that it cannot continue to teach what it professes to teach without the appointment of some such officer. I am recommending merely that his appointment be seized as the opportunity of starting what in the future may be of inestimable value to the whole world—the establishment of an efficient School of Astronomy, in a high southern latitude, and in a climate peculiarly suitable for astronomical work.

# TYPHOID IN HOBART AND MELBOURNE, AND THE INFLUENCE OF DRAINAGE ON ITS PREVALENCE.

By James Jamieson, M.D.,

Health Officer, City of Melbourne.

(*Read October 13th,* 1902).

At the meeting of the Intercolonial Medical Congress at Melbourne, in 1889, the subject of typhoid was largely considered, and was adopted as the matter of discussion at one of the general meetings. At the end of that discussion a series of resolutions were proposed and carried unanimously. The first affirmed: "That the prevalence of typhoid is owing mainly to insanitary conditions, and above all to contaminated water supply, defective drainage, and improper disposal of night soil." By the second it was declared: "That while there is reason to believe that the sources of the water supply of Melbourne are carefully guarded, it is certain that, as regards drainage and night soil disposal. the arrangements are very unsatisfactory, and to these defects must be ascribed in great measure the excessive prevalence of typhoid fever year after year." By the third it was affirmed: "That in the opinion of this Congress, it is the imperative duty of the Government to take immediate steps for bringing about an improvement in the sanitary condition of Melbourne, and specifically for the construction of a proper system of underground drainage, which shall include the removal of night soil by water carriage."

Though these resolutions had properly enough special application to Melbourne, the affirmations were equally true of other places where conditions at all similar prevailed. The late Dr. Richard Bright, who took part in the discussion, and seconded the last of the resolutions, declared in a very positive way his belief that the excessive prevalence of typhoid in Hobart, in the years just preceding the meeting of the Congress, was greatly owing to the pan system.

The resolutions took the shape they did very largely to strengthen the hands of the medical profession in Melbourne in their struggle for sanitary reform. It may be assumed that their unanimous adoption and vigorous wording had the effect intended, since the Government soon after engaged the services of an eminent London engineer to report on the best method for carrying out a scheme of underground drainage In 1890 that report was received, and a Metropolitan Board of Works constituted, with control of water supply and drainage. With some modifications the proposed plans were adopted, though for several years progress seemed to be slow.

About five years ago house connections began to be made, and now (*August, 1902) 48,000* buildings out of about 100,000

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have been connected with the sewers, and the pan system abolished, so far at least as concerns these places. Of course very much remains to be done, and as was proper, the central and more populous districts, and the suburbs on the line of the outfall drain, were the first to benefit. Clearly the full advantages from the point of view of sanitation are far from being attained, but it may be possible to show that they are considerable.

It might have been expected that an enlightened self-interest would have led the citizens of Hobart, as a place of summer resort, to realise the enormous benefits any such place must derive from a good sanitary reputation. And there is nothing more likely than a fear of typhoid to check the influx of visitors. Without throwing doubt at all on the attractions of Hobart, both as a beauty spot and a good health resort, it must be admitted that, up till quite recent times, it shared the evil fame of Melbourne as a hot-bed of fever. And a comparison of the mortality returns brings out some striking points of similarity between the two cities. Taking the period since 1890, such a comparison brings out the very striking fact that the specially fatal years in both places were 1890-91 and 1898, and the year between these, showing the lowest typhoid mortality was also the same, viz., 1893.

The concomitant variations are much too striking to admit of explanation by the easy way of "accidental coincidence." They strongly confirm the opinion, which I have long held and frequently expressed, that general conditions of the meteorological kind have much to do in determining the fluctuations of typhoid prevalence in particular localities from year to year. I must admit further that my endeavours to fix the exact nature of these meteorological, so-called cosmic, conditions have been attended with rather a scant measure of success (*v.* Proceedings of the Australasian Association for the Advancement of Science, Vol. II., Melbourne, 1890, and *Australian Medical Journal*, March, 1890). And, indeed, looking at the enormous fluctuations in the typhoid mortality, year by year and in almost a parallel way, in the two cities, it might seem as if they had been left at the mercy of these general conditions up till quite recent times.

But knowledge has grown, and from application of that knowledge improvements of many kinds have resulted. And just as the fatality from consumption was steadily becoming less in most countries, independently of any recognition of its infectious character, and without much in the way of special precautions, so with typhoid the death rate has been undergoing diminution, even though certain essential improvements may not have been adopted.

In a paper read before the Royal Society of Tasmania by *Dr Gregory* Sprott in August, 1898, the argument in favour of the adoption of a proper drainage scheme was put in a very forcible manner. At that time both Hobart and Melbourne showed very unfavourably in the comparison of mortality rates, not only with European conditions, but even with Sydney. Since then there has been a great change for the better, and for several years it has been a pleasure to me to be able to point out that the deaths from typhoid in Melbourne had at last been reduced to such an extent that the mortality compared favourably with that of the great English towns. And comparatively low as the rate now is, there is every reason to hope, from analogy of what has happened elsewhere, and notably in some of the German cities, that the lowest point has not yet been reached.

In presenting, in tabular form, the death rates from typhoid for a series of years, in Hobart and Melbourne, it is not necessary to go further back than 1890, as by the help of these figures we can make comparison of periods for which reliable census figures of population are available. Calculations based on estimates are apt at times to be fallacious, and especially in our case, where census periods are as long as ten years apart.

The following table gives a comparison of the rate of mortality from typhoid, in Hobart and in Melbourne, for the 12 years 1890-1901:—

PER 10,000 OF POPULATION.

| | Hobart. | Melbourne. |
|---|---|---|
| 1890 | 5·1 | 8·5 |
| 1891 | 16·7 | 3·9 |
| 1892 | 5·7 | 3·2 |
| 1893 | 2·5 | 2·6 |
| 1894 | 4·8 | 3·5 |
| 1895 | 5·8 | 3.2 |
| 1896 | 4· | 3·3 |
| 1897 | 3·4 | 2·6 |
| 1898 | 8·1 | 4·7 |
| 1899 | 1·6 (? 2·) | 2·9 |
| 1900 | 1·6 (? 2·) | 1·9 |
| 1901 | 2· | 1·4 |

The rates for Hobart are taken from the reports of the health officer, and as regards at least the years 1899, 1900, they almost certainly require correction, since the population had been overestimated by almost 6000, implying an addition to the rate of about one-fourth, and making it more probably 2· than 1·6, as given in the table. On the other hand the census returns showed that the estimates of population for Melbourne had been a close approximation to the true numbers. On analysing the figures given, the first thing at once noticeable is the great decline in the mortality rate in both cities, in the three last years of the period. Another is that the fluctuations *from year* to year are much greater in

# SEWAGE PURIFICATION AND DISPOSAL.

(Edwin H. Wilkinson, Engineer for Drainage, Hobart.)

(Read October 13, 1902.)

The subject of the disposal and the purification of sewage is one that has of late years received the close attention of the greatest scientists. More especially is this the case in the United Kingdom. It will be my endeavour this evening to describe a few of the various methods adopted for purifying the sewage, and the agencies whereby this state is brought about, together with various methods of disposal in use in various parts of the world. For much of the information contained in this paper (for which I claim no originality) I am indebted to the work by Mr. Dibdin on the purification of sewage and water. A very great deal of useful matter was also obtained from a recent "Report on the Latest Methods in use in the United Kingdom and elsewhere," by Mr. J. Davis, M. Inst. C.E., who was until lately Engineer-in-Chief for Sewerage Construction in New South Wales.

In the bacterial disposal of sewage, as carried out at many places, we assist nature in carrying out her work without offence and without danger to us. When an animal dies and remains unburied in the fields, Nature's scavengers, in the form of bacteria, soon make themselves evident, and in a comparatively short time entirely dispose of the carcase.

In order to more forcibly impress upon you this bacterial life, which plays such an important part in the purification of sewage, I ask your permission to be allowed to quote from some of the remarks of Mr. W. J. Dibdin, late Chemist to the London County Council.

Firstly, sewage consists of animal substances, largely composed of fibrine, gelatine, chondrine, albumen, etc.; and, secondly, vegetable substances, such as starch and woody fibre (cellulose), gummy matters, with tannin, etc. The decomposition takes place by the active organisms, "aerobic," as they were called by Pasteur in contradistinction to the anaerobic organisms. As their name implies, the first-named live only in the presence of air, whilst the latter live in the absence of air. When air is freely present the aerobic organisms destroy the organic matters in an inoffensive manner.

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Such, then, is Nature's method of purification.

The process is termed biological, but it must not be supposed that because this term is used in reference to the treatment of sewage, it is intended to imply that the micro-organisms are provided by the bed itself, and that the sewage does not contain them. The organisms are to be found in all sewage, and they are by the sewage conveyed into the beds, where large surfaces are provided, and on which the bacteria are cultivated.

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According to Dibdin, the nitrogen of the gelatine, etc., is resolved with either *the production of ammonia* and the oxides *of nitrogen, or possibly set* free as uncombined nitrogen. The oxygen and hydrogen, forming a considerable portion of the matters, are recombined into water, and the carbon into "carbon dioxide," or carbonic acid gas, as it is generally called. Similar transformations take place with these elements in vegetable matters, but a longer time is usually required for the completion of the process than is the case with animal substances, as they do not form so suitable a medium for the support of the microbic life. Woody fibre, especially paper pulp, is more refractory, and will require a much longer time for its disruption, but in the end the same transformation occurs, and carbonic acid, water, etc., are formed as a result.

It will be understood that the substances mentioned are intended to represent only types of compounds actually present in such a heterogeneous mixture as that which we are considering.

In the process known as combustion, or burning, the organic matters combine with oxygen, but the same action is brought about by the life processes of animals.

In the case of the higher animals, when the food is taken into the stomach, it there undergoes the process of digestion, and a portion is absorbed into the system, where, by the action of the blood, it is eventually oxidised as it rushes through the lungs, in which it is freely exposed to the air taken in by the breath. Thus is kept up a slow process of oxidation, marvellous in its character and action. It matters not whether it is meat and bread eaten by human beings; grass, etc., by horses or fowls; or a mixture of these things by microbes or by the direct action of fire; the final result is precisely the same, viz., combustion, fast or slow, as the case may be. But in bringing about this result we must not neglect to ensure an ample supply of oxygen, otherwise we shall have foul gases formed, such as sulphuretted hydrogen, and so create a nuisance.

Here we must further consider the action of the minute organisms already referred to as "bacteria," or "microbes."

These are minute living bodies, some of which are ever present in various forms in or on every substance known; and whenever the circumstances are favourable they bring about the destruction of the organic matters simply by living on them. In reference to their general character that while at first they were thought to belong to the animal kingdom, it is now generally accepted that they are plants. With reference to the size of the bacteria,

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Mr. Scott-Moncrieff states that the invariable result, where he put down installations of these tanks, based upon an allowance of 3 or 4 cubic feet for each inhabitant served, has been the almost complete liquefaction of the solid matter, and the sludge in every case was a negligible quantity. His next step was to pass the effluent from the cultivation tank through shallow, open earthenware drains filled with coke, but it appears that this treatment had very little effect upon the effluent. However, it was observed that when it passed into an almost stagnant, but bacterially very active, ditch, in the proportion of one to three respectively, the effluent purified what was before a polluted stream. This fact (which to many may be hard to believe) will again be demonstrated further on in this paper, when dealing with experiments carried out with the Manchester sewage.

Using Mr. Scott-Moncrieff's own words, he states that this proves two things:—"First, that the ditch was a very active oxidising agent; and, secondly, that the organic matter coming from the 'cultivation tank' was in a condition highly susceptible to further oxidising changes, and was in a much more unstable molecular condition than the raw sewage, which had seriously polluted the stream when untreated."

He next devised a highly oxidising apparatus consisting of nine wooden boxes (perforated), 7in. deep, and each having an area of 1 square foot, which he placed 2in. apart and above each other. These he filled with coke about the size of beans. In utilising the filtering material for restoring oxygen to the sewage to the fullest extent, he used V-shaped tipping channels, so that the liquid would be evenly distributed.

Installations have been carried out on this plan in several places, notably at Birmingham, at Chelmsford, and at Caterham, under the sanction and authority of the War Department. At the latter place there is exceedingly strong sewage from the barracks, which accommodate 1,200 persons.

Dr. Rideal, who was asked by the War Department to report on the efficiency of the installation at Caterham, states the results are satisfactory, and that "the process has been successful in destroying *completely* four-fifths of the total organic *matter present in raw sewage.*"

### Septic Tanks.

Under the septic tank system t
est installation as yet carried ou
Barrhead, where the works are
to serve a population of 10,000, and
fy a maximum flow of sewage an
water of 400,000 gallons per day.

The works consist of two grit ch
four septic tanks, and eight bacter
all of which are built with concre
sewerage main discharges into t
chambers, from which the sewage
without screening, into the septi

When the septic tank system w
introduced it was thought that it
cessary to exclude all light and a
is now found by experience that the
obtained from raw sewage are th
whether the tanks in which the a
microbes are active, is covered o
This may be due, perhaps, to the
of hard scum which is formed in th
and which would tend to exclude t
and air.

There may be cases, however, wh
various reasons, it would be advis
cover the tanks. For all practic
poses it is settled beyond dispute t
open is as efficient as the closed ta

### Manchester Sewerage.

To prevent the pollution of th
chester Ship Canal, in 1896 proc
were instituted against the Corp
at the County Police Court, and a
made calling upon the Council to d
was necessary within 12 months.
period has had to be extended, as
found impossible to make the ne
experiments to enable a conclusio
arrived at in the time given.

Eventually a scheme was prepa
conveying the effluent from Davyhu
the tidal River Mersey at Ra
sluices. When this scheme was r
to a poll of the ratepayers it was r
by a large majority. Messrs. L
Frankland, and Perkins, expert
were called in to advise the Counci
the question, supported the ratepa
their decision.

The Council thereupon decided
point the three experts already na
advise them and report on the whol
tion of sewage purification and di

Up to this time no adequate expe
had been gained in the use of bacteri
with sewage diluted with trade re

Upon getting to work the experts
confined their attention to the thr
thods which had been already befo
Council:—

1. Treatment by land.

2. Conveying the effluent into the
portion of the river.

3. Bacterial treatment.

rding the question of land treat-
:hey agreed with the committee in
g it; firstly, on account "of the
nitial cost of land, drainage, con-
aying out, etc.;" secondly, "of the
difficulty of obtaining a sufficient
and, thirdly, "of the general un-
ity of the land in and around
ılme." With respect to this, they
ed the case of Birmingham, which
feeling the formidable dimensions
ewage farm to such an extent that
nd more compact modes of dealing
e sewage are being undertaken.

xtensicn of the sewer to Randall's
was condemned from an engineer-
at of view.

r their direction, certain beds were
cted at Davyhulme, and experi-
vere made with them. The filter-
dium used in the upper bed was
, 3in. to 1in. gauge; and in the
ed 1in. to ½in. gauge. Two other
similar size, and a fifth, much
, were afterwards added, but the
s used were of much smaller mesh,
as found that the coarser filters al-
sludge to get into the body of the
d so into the drains below. The
l used in the third, fourth, and
ds varied from ¾in. to ¼in. mesh.
ed sewage was first used, the beds
filled once each day for the first
and twice a day for four weeks. The
aving acquired a high degree of
cy at the end of this period, were
hree times a day for a further term.
e application of settled sewage was
ed with such satisfactory results,
decided to apply raw sewage on the
ines. For the first month the raw
was applied once each day, and
tled sewage twice. This having
satisfactory the raw sewage alone
plied three times a day, and was
ued for nearly two months, when
llings per day were tried. After
st week the rough bed showed signs
ging, and settled was therefore re-
to. The experiments with these
ave extended over a period of two
The effluent from septic tanks
instead of settled sewage, ulti-
passed through the beds. The
ty of the beds was at first
r reduced, but when the solids in
sion from the raw sewage had pre-
been removed, by bacterial action
septic tank, and the beds had got
to work, they maintained a capa-
of one - third of the capa-
of the bed without filtering
al. When a bed fell below this
tion a short period of rest would be
ans of restoring it. The larger
vere constructed to contain 10,000
before the clinkers were put in,
hen working their capacity was
allons.

The beds were treating the effluent from the septic tank at the rate of 600,000gal. per acre, with a resultant degree of purification of 0.5 grains per gallon oxygen absorption in 4 hours; and 0.04 grains per gallon of albumenoid ammonia. The limits of impurity adopted by the Mersey and Irwell joint committee (the authority which has the responsibility of the conservation of the rivers in question) is 1 grain and .1 grain respectively.

In their report the experts say: "The results of the treatment of the open septic tank effluents . . . . . have, from the first, surpassed our most sanguine expectation."

It has been found, with the use of the effluent from either open or closed septic tanks, one contact with a bacteria bed has been sufficient to secure adequate purification.

At the end of 1898 an experimental installation of the septic system was got to work. After it had been working about nine months to try its powers of dissolving solids, garbage was tipped into the tank. After 279 barrow-loads were put in, it was decided to cease. The tank was constructed in size sufficient to hold half a day's supply of sewage. If it had been used as a precipitating tank, at the end of fourteen months the quantity of sludge produced would have been about 12,000 tons, but, upon being emptied, it was found to contain 4,000 tons of sludge, and the garbage had been wholly dissolved. The greater portion of this residue was inorganic matter; the proportions were 60 per cent. inorganic and 40 per cent. organic. A large proportion of the inorganic matter, if not the whole, is recognised to consist principally of silt from the street surfaces, and silt pits are being specially constructed to intercept it before the sewage reaches the septic tank. The rapid rate at which the sewage was passed through the tank may account for the comparatively large amount of organic matter, 1,333 tons. Notwithstanding this, it is a very great attainment to have succeeded in destroying two-thirds of the solid matter, and that, too, when passing the sewage through the tanks twice as fast as is usual in other places. Experiments made at other places show that the most perfect bacterial action is obtained by allowing the contact to be twenty-four hours. A closed septic tank was treating sewage during the whole time the sewage was passing through the open septic tank, and samples of the effluent, taken under similar conditions, show that the results for all practical purposes may be regarded as the same.

The sludge which is not retained in the septic tank passes away in a highly-divided condition in suspension, and by gasification.

From samples of the effluent taken from

the maximum flow the results show that the suspended matter varies from 11.6 to 4.9 grains per gallon.

Exhaustive experiments have been made to determine the effect the effluent from the bacteria beds would have upon the waters of the Manchester Ship Canal. Average samples of the filtrates were taken from the bacteria beds in operation on 132 days. A similar quantity of water was taken from the Ship Canal, and the two were mixed. The Ship Canal water, except in a few cases, when it had been diluted by heavy falls of rain, was putrescible to a high degree, but when mixed with an equal quantity of the filtrate, the mixtures in 117 cases were non-putrefactive. This shows clearly that the organic impurities of the Canal water had been oxidised at the expense of the nitrates in the filtrate, and thus vastly improved. It also bears out the fact demonstrated by Mr. Scott-Moncrieff, and already alluded to.

Of several the following were among the conclusions and recommendations made to the Council by the three experts:—

1. That the bacterial system is the system best adapted for purification of the sewage of Manchester.

2. That any doubts which may have arisen in the first instance as to its suitability . . . . have . . . . been entirely banished. The results obtained have altogether exceeded our expectations.

3. . . . . by passing the sewage as it arrives at the works through an adequate system of screens, etc., the further important advantage is gained, whereby those anærobic or septic processes are developed, and which resolve into gaseous and soluble products the organic suspended matter present in the sewage. A large proportion of the sewage sludge which otherwise accumulates, and the disposal of which causes so much trouble and expense, is thereby abolished. The above anærobic or septic process is found to take place as effectively in an open tank as in a closed one.

It has been demonstrated that the septic tank can effectually dispose of between 40 and 60 per cent. of the suspended matter present in the sewage. A kind of digestive process goes on whereby much of the insoluble suspended organic matter, especially that of animal origin, is liquefied or dissolved. This is probably entirely due to the action of those living organisms previously alluded to, by whose vital processes some ferment or ferments are produced which digest these substances. Vegetable fibre is more resistant, and is but little affected. In alluding to this phase of the subject, Dr. Thresh, in a recent paper, says:—"What is wanted is the discovery of some organism capable
of being cultivated and utilised,
possesses the special power of di
vegetable fibre." In the same p
mentions a visit he paid to the
age works at Buxton, where he fo
settling tank almost full of deposit
ter. Using his own words, he sta
"a few days later some kind of fe
tion had set in, and the fluid w
vescing vigorously and in a ver
time practically the whole of th
matter had been dissolved and
away."

At Leeds, where the Corporat
carrying out extensive experimen
the bacterial purification of their
the oldest of their septic tanks h
working over fifteen months.
quarters of the solids in suspensi
left therein, and no sludge had b
moved, yet after inspection it wa
that the tank contained no more
than it did six months earlier.
condition showed that there had
tionably been an enormous consu
of sludge in the tank by septic pr

Before concluding this paper
ence to the Liernur system of s
might prove of interest. The town
to be served is divided into distri
cording to circumstances, and in
trally situated position a closed
is provided for each district, into
the fæcal matter is drawn by
There are cast iron pipes laid al
streets, and so situated as to enabl
connections to be conveniently
These pipes convey the sewage to
trict receivers. From the centr
tion the vacuum there formed is co
to the district receiver, and the in
of this causes the sewage to flow
tion to the receiver. The distr
ceivers are in turn emptied by a
the vacuum to the main receiver
central station. Briefly then, th
nur system consists of ordinary stre
ers (4in.) connected to a main se
to 12in.), without any openings.
end, by the house, is a patent sy
box. At the outfall works is a stee
cylinder, in which a vacuum is c
say once a day. The result is, t
age remaining in the boxes and se
carried off to the works at six tin
speed of water-carried sewage,
flush being depended upon to clea
pipes thoroughly.

From information supplied by t
lish representatives of the syste
also by their engineer, Mr. Theodo
nert, M. Inst. C.E., there are three
lations at work; one at Amsterda
at Trouville-sur-Mer, and the oth
gold mine in Johannesburg.

It is understood that at Amster
was the intention of the designers
evaporate the fæcal matter, but t

ound impracticable. It is now cus-
to use a small quantity of water
shing purposes—about 1 gallon per
. The house slops at Amsterdam
t taken into the sewerage system.
e discharged into the various canals
tersect the city.

rding to Mr. D. I. Sanches the en-
in charge of the works, the total
tion of Amsterdam is about 500,000,
these about one-fifth, or 100,000, are
by the Liernur system. The street
are now laid to an uniform grade
he upper end to the district receiv-
d with ordinary junctions, as it was
that the vertical junctions, with
ngled bends, which were originally
ed, readily got stopped.

average number of persons connect-
h a district receiver (of which there
) is 2,000. The greater portion of
sets are of the special Liernur kind.
mode of treating the sewage devised
rnur has been entirely abandoned.
pense of drying the sewage was so
even without the household slops,
ith only the small quantity of wa-
ed as a flush, that it was found ne-
y to discontinue the method.

sewage, as soon as convenient, after
ival at the works, is precipitated by
of lime, and the supernatant liquor
he sludge are boiled separately for
rpose of throwing off the ammonia.
s sold, and a fair revenue is derived.
upernatant water is thereupon dis-
d without further treatment into
nal, and the sludge is mixed with
rubbish and removed in barges as
re.

a process is wholly objectionable.
ands of gallons of sewage are stored
ge, open tanks, waiting for a number
ys to be treated. Another source
inconsiderable nuisance is the me-
f mixing the sludge (previously de-
of its ammonia) with the house refuse. In cases where the town to be served is flat some mechanical means of raising and removing the sewage is necessary, and it becomes apparent that each case therefore must be taken on its merits. However desirable it may appear to evaporate the moisture and produce the powder manure, the question of cost would make the method prohibitive. With the knowledge we now possess as to the bacterial action, which can be so readily engaged in resolving sewage into its elements, there is certainly no necessity to resort to evaporation as a means of disposal.

Coming to Hobart the author said that within the next few months the citizens would be asked to say whether or not a scheme for the drainage of the city on modern sanitary principles was desirable. Many were averse to allowing crude sewage to empty itself into the harbour, on the grounds of pollution, but, at the present time the foul slop waters from the houses were allowed to discharge into the street channels, whence they found their way into the natural water-courses, and so on to the waters of the Derwent estuary. From the configuration of the city and its environs, and from an engineering point of view, the natural place for discharging the sewage was at Macquarie Point, where there was deep water, enhanced by an ample tidal flush. With the expenditure of a few thousand pounds, over and above the sum required for a complete system of sewerage, the sewage of Hobart could be rendered quite innocuous, and purified to such an extent that the waters of the harbour would always retain their present standard of purity. It could readily be accepted as a fact, from the knowledge we now possessed of bacterial action, that, by passing all the solid matters through septic tanks before they entered the harbour, the liquefaction of the sewage could be assured, and the pollution of the estuary reduced to a negligible quantity.

# ON TENISON-WOODS TYPES IN THE TASMANIAN MUSEUM, HOBART,

BY W. L. MAY.

*Read October,* 1902.

It is known to all workers in Australian Conchological Science that the late J. E. Tenison-Woods, during the years 1875 to 78, described a large number of Tasmanian Marine Shells in the proceedings of this Society.

His species are usually fairly well described, but he published no figures, and with a few exceptions the specimens he used were not marked as types.

Owing to many of these species also occurring on the coasts of Southern Australia, and which have since been discovered and worked up by scientists there, they have taken an important place in their investigations, but owing to the want of figures, and particularly types to authoritatively settle uncertainties and differences of opinion, some confusion and considerable irritation have been caused. The Tasmanian workers could not definitely assert that any species referred to them was certainly Woods' species without the type, and could only assume that it was so because it agreed with specimens so named in the Museum, or through tradition handed down by W. Legrand, C. E. Beddome, and others, and they were in consequence sometimes taunted with not knowing their own shells.

In this way some errors crept in amongst lists and collections, and Australian workers made frequent mistakes, for which on the whole they had considerable excuse.

So lately as during the preparation of the Revised Census of Tasmanian Marine Shells, *Tate and May*; the authors were still troubled by this want of definite types, and did not venture to quote the Museum specimens as such, unless so marked, which made the work less complete and authoritative than it otherwise would have been, and also led to several errors. But a better day has dawned, and it is the object of this paper to make public the steps lately taken to place this vexed subject on a satisfactory basis.

During the sittings of the last Congress of the A.A.A.S. at Hobart in January, 1902, several leading conchologists were present from various Australian States, and after some preliminary conversation on the subject, they formed a committee to investigate, and if possible settle, the question as to whether Tenison-Woods's species so named were the types, and, if so, definitely mark them as such. The names of those comprising the committee should be a sufficient guarantee of *careful* and thorough work, and it is not probable that their decisions will ever be seriously questioned. They are as follows:—Charles Hedley, conchologist, Australian Museum, Sydney; G. B. Pritchard, Melbourne; Miss M. Lodder, Tasmania; W. L. May, Tasmania. With the cordial consent of the Curator, Mr. Alexander Morton, the work was taken in hand. As a preliminary, I was able to state that to my personal knowledge the collection, so far as Woods's species were concerned, had remained practically unaltered since his time.

All his species described before the publication of his census are labelled with slips cut from that work, or in his handwriting. Those described since are in his handwriting. It therefore seemed to us all that it was sufficient evidence that we were dealing with his type specimens if they were labelled as described, particularly as the shells always agreed with his description, and sometimes had some peculiarity which further identified them. In some cases the author's handwriting was on the card in addition to the printed label, and there are some instances in which they are marked as "type." An additional point in evidence was that Woods described some half dozen exotic species received from Ronald Gunn with the mistaken identification of their being Tasmanian. There is but one specimen of each in the Museum, and there is no doubt that they are the type, but they were not so indicated with the other species, and labelled with slips from the census. See also Woods's note at the end of his paper "On some Tasmanian trochidæ." P.R.S., Tasmania, 1879, where he makes certain corrections of some names contained in his census. He says, "I have to thank Mr. W. F. Petterd and Mr. W. Legrand for having carefully gone over the *whole of the type specimens* for me to ascertain the above corrections. The italics are mine. None of the species referred to in this note were marked as type. We therefore unanimously agreed to take the above indications as a guide, and were able to definitely decide as to over 150 species, which are now marked as *type*.

The following is a full list of these types, with a few remarks where necessary as to the condition of the specimen, etc., or where some fresh facts have been ascertained which it seemed well to place on record. I have thought best to keep entirely to Woods's names as they were described. The corrections of both generic and specific names will be found in Tate and May's Census. I have also taken the opportunity to correct some errors in that work particularly affecting these species, but where I consider they have correctly treated the synonomy, and properly identified the species, I shall not again refer to them. I have also prepared drawings from the types of such species as have not yet been figured, or but inaccurately or wrongly so, and they will appear as figures in the text of this paper, which I hope will be of distinct service to workers in Australasian Conchology.

It seemed as well to add for general information that the whole of the types of Tate and May's species (with the exception of Cantharus kingicola now in possession of Dr. Vercoe, of Adelaide, S.A.), amounting to 30 species, are also in the Tasmanian Museum, as well as a considerable number of W. F. Petterd's types, and one of C. E. Beddome's, viz., *Leda lefroyi*.

## LIST OF TYPE SPECIMENS.

Murex zonatus.
Trophon assisi.
Trophon australis.
Trophon brazieri.
Trophon clathratus.
Trophon goldsteini.
Trophon squammosissima.
Trophon umbilicatus.
Purpura albolirata.
Purpura littorinoides.
Purpura popinqua.
Pisania tasmanica.
Ranella epitrema.
Fusus legrandi.
Fusus spiceri.
Siphonalia clarkei.
Siphonalia castanea.
Siphonalia turrita.
Siphonalia pulchra.
Cominella tasmanica.
Cominella tennicostata.

Josepha tasmanica. This type was, but is no longer, in the collection. The late C. E. Beddome told me that he had the loan of this, and several other types, which he sent to Tryon, to assist him with his Manual. They were returned to him and handed to the late Curator, but have never been replaced in the collection, and cannot now be found.

Nassa tasmanica.

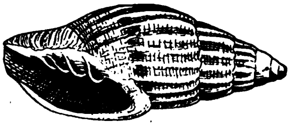
Mitra franciscana.

Mitra granatina. The same remarks apply to this as to *Josepha*. From my recollection of the shell I should certainly consider it to have been an exotic species.

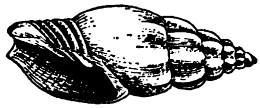
Mitra legrandi. There are three small and probably original specimens on the card, and one larger and perhaps later addition. The former, which we regard as typical, are young shells, and are the variety *Schomburgki* angas.

I agree with Pritchard and Gatliff, P.R.S., Victoria, p. 189, 1899, in uniting these species together with *Scalariformis*. The large specimen mentioned seems to be a form of *vincta*.

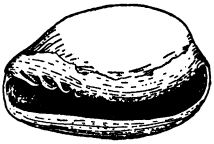
Mitra scaliformis.
Mitra tasmanica. (Fig. 1.)


(Fig. 1.)

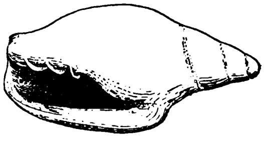
On the card are 4 specimens, amongst which it is easy to identify the type and vars. A and B. I consider this to be a very distinct species, not to be confounded with any one of our ribbed mitras: its peculiar form and distinct spiral liræ are very constant. Woods gives no habitat, but the few speimens I have received are from the Derwent Estuary. Var. A. This is *M. tatei* angas, and in no sense a var. of this species. Var. B is very distinct, and whilst I do not consider it to be a variety of this, it has some resemblance in form. It almost merits a specific name; but these shells are so variable and so overloaded with synonomy already, that, without a large series of specimens, it would be unsafe to separate it as a new species. It may be an extreme form of *M. vincta* or *M. scalariformis*. I have 2 specimens from Port Esperance, exactly similar. Fig. 2.


(Fig. 2.)

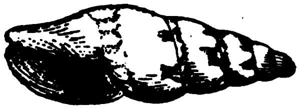
Mitra teresiæ.
Mitra weldi.
Mitra scita.
Marginella allporti.
Marginella cypræoides. (Fig. 3.)
Marginella minutissima.
Marginella stanislas. I now believe this to be a syn. of M. volutella.


(Fig. 3.)

Marginella tasmanica. (Fig. 4,)
Columbella badia.
Columbella roblini.
Columbella dictua. I consider now that these 3 species should be combined as varieties of one very variable form. *C. vincta*, Tate, should also be included; in fact, one of the specimens mounted as *C. badia* is the variety *vincta*. Reeves's figure *C. irrorata* is, in my opinion, another variety.


(Fig. 4.)

Columbella legrandi. (Fig. 5.)
Columbella minuta.
Columbella xavieriana.
Columbella miltostoma.
Conus carmeli.
Conus macleayana.
Drillia philipineri.
Drillia tœniata.
Drillia agnewi.

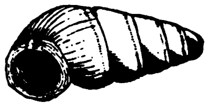


(Fig. 5.)

Drillia weldiana. C. Hedley, Notes on Tasmanian Conchology, 1902, identifies this as D. *fucata, Reeve.* Woods refers to this species in his description. It is certainly exotic.

Drillia immaculata.
Drillia atkinsoni.
Drillia minuta.
Drillia incrusta.
Mangelia desalesi.
Mangelia meredithæ.
Mangelia St. Gallæ.
Mangelia atkinsoni.
Cythara tasmanica
Daphnella tasmanica.
Daphnella varix.
Cancellaria tasmanica.
Tenagodus weldii.
Turritella acuta.
Turritella atkinsoni.
Turritella granulifera.
Crossea cancellata.
Crossea labiata.
Eulima micans.

Eulima tasmanica. (Fig. 6.)



(Fig. 6.)

This is undoubtedly a *Rissoia*, but is wrongly placed as a synonym of *R. dissimilis* by Tate and May. It appears to be distinct from all other species, so should stand as *R. tasmanica..* It is almost identical in form with the species figured in Tate and May as *Rissoia tumida*, but the oblique striæ are very fine, so that unless it is very carefully observed it appears smooth, and even polished.

Syrnola bifasciata.
Syrnola michaeli.
Styloptygma tasmanica.
Odontostoma tasmanica.
Parthenia tasmanica.
Elusa bifasciata.

Turbonilla angasi.

Turbonilla macleayana.

Turbonilla mariæ.

Turbonilla tasmanica. From further careful examination of the type this is certainly *Truncatella scalarina* in the undecollated state; the specimens are very white.

Aclis tristriata.

Bittium minimum.

Ceritaiopsis tasmanica.

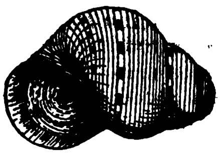
Triforis tasmanica.

Triforis tasmanica. Var. A. The specimen is broken, but what remains shows it to be *T. pfeifferi* Cr. and F.

Diala punctata.

Diala tessellata.

Diala tumida. The shell figured as such in Tate and May, Fig. 67, is not this species; the type shows it to be closer to *Rissoia olivacea* of which it may be a variety; it is longer, with flatter whorls and fewer ribs than is shown by typical *olivacea* from Port Jackson. The type is much beach worn.



(Fig. 7.)

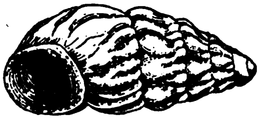
Fossarus bulimoides. The type is a juvenile example of *Adelacteon casta*. A. Adams.

Fossarus tasmanicus.

Cingulina australis.

Littorina hisseyana. (Fig- 7.)

Rissoina St. Claræ.



(Fig. 8.)

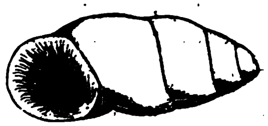
Rissoina flindersii. I find this has been wrongly united with *Diala pagodula* by Tate; first in his "Revision of the Recent Rissoidæ of Australia," T.R.S.S. Aus., 1899, and similarly in Tate and May Census, p. 388. An examination of the type shows it to be a *Rissoia* of the section *Amphithalamus*, the mouth being quite characteristic, and entirely different from *Diala*. I have examples of the species from South Australia. Fig. 8.

Rissoina gertrudis. See Notes on Tasmanian Conchology, 1902. C. Hedley.

Rissoina concatenata. Type badly broken.

Rissoa cyclostoma.

Rissoa cyclostoma. Var. rosea. This has been re-named *R. woodsi*, by Pritchard and Gatliff, P. R. S. Victoria, 1901, who rightly regarded it as distinct from *R. cyclostoma*. The types have bleached perfectly white. Fig. 9.

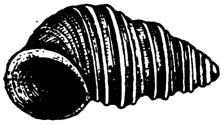


(Fig. 9.)

Rissoa fasciata.

Rissoa cheilostoma.

Rissoa agnewi. (Fig. C.) This is distinct from *R. layardi Pett.*, which will now be restored to specific rank; they are somewhat closely related, but whilst in the latter the keels are close set; in the former they are separated by a considerable interval. Fig. 70 in Tate and May, represent *R. layardi*. The type of which I have seen. Fig. 10.



(Fig. 10.)

Rissoa mariæ.
Rissoa melanura.
Rissoa atkinsoni.
Rissoa minutissima
Rissoa unilirata
Rissoa maccoyi.
Rissoa siennæ
Rissoa brazieri
Rissoa angeli.
Rissoa punctato-striata.

Cyclostrema weldii
Cyclostrema susonis
Cyclostrema micra

The types of these three species are crushed to atoms, which disaster occured during an unfortunate removal some years ago. Happily I had carefully examined them when intact, with the result given by Tate in T. R. S. S., Aust. XXIII, Cyclostrema, and in Tate and May.

Cyclostrema josephi.

Cyclostrema immaculata. Type crushed.

Adeorbis picta. This=*Omphalius faciatus*, Born. *Vide* C. Hedley, Notes on Tasmanian Conchology, June 10, 1902.

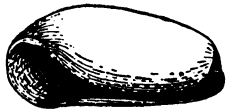
Ethalia tasmanica. This=*Modulus modulus*, Linne. Hedley loc. cit.

Liotia annulata. Type crushed. Same remarks apply to this as to *Cyclostrema.*

Liotia incerta.

*Liotia tasmanica.*

Turbo simsoni.
Turbo cuculata. This = *T. radiata*, Gmel. C. Hedley loc. cit.
Monilea rosea.
Monilea turbinata. This = *Omphalius scalaris*, Anton. Hedley loc. cit.
Clanculus aloysii.
Clanculus raphaeli.
Clanculus philomenæ. I now think that these three species may all be varieties of *C. yatesi*, Crosse.
Clanculus angeli.
Clanculus dominicana.
Gibbula multicarinata.
Gibbula aurea. This seems to be conspecific with *G. smaltata*, Fischer, and is possibly distinct from *G. tiberiana*, Crosse = *Thalotia tessellata*, Ten. Woods.
Gibbula dolorosa.
Gibbula weldii.
Zizyphinus allporti.
Zizyphinus legrandi.
Margarita tasmanica.
Diloma australis.
Euchellus tasmanicus.
Schismope atkinsoni.
Macrochisma tasmanica.
Tugalia tasmanica.
Tugalia australis.
Patella chapmani,
Patella tasmanica.
Acmæa alba.
Acmæa crusis.
Acmæa petterdi.
Acmæa marmorata.
Cylichna atkinsoni. (Fig. 11.) It is larger and more tapering than any examples of *C. pygmœa* A.Ad. that I have seen, but is otherwise very similar.

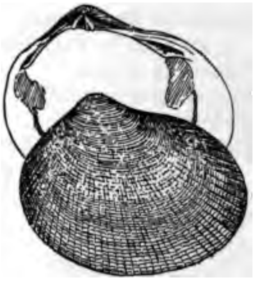


(Fig. 11.)

Aplysia tasmanica.
Ampullarina minuta seems to be young of *A. fragilis.*
Auricula dyeriana.
Dentalium weldiana.
Gastrochaena tasmanica.
Neœra tasmanica
Semele warburtoni. This = Lucina *(Codakia)* orbicularis Linne (C. Hedley loc. cit.)
Myodora tasmanica.
Gouldia tasmanica. Types considerably broken.

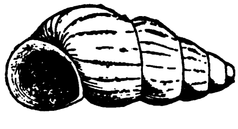
Macoma mariæ.
Chione macleayana? = C. Stutchburyi Gray juv., probably exotic.
Callista victoriæ.
Dosinia immaculata.
Rupellaria reticulata.

Lucina minima. (Fig. 12.) There are two specimens mounted on the card, representing different species. The larger example has the valves separated, and was doubtless that from which Woods described his species, as he refers to the interior; so I regard this as the type, especially as it agrees well with the description and *dimensions* given. It is very close to *L. perobliqua*, Tate, but that shell seems to be stronger and coarser in the sculpture, especially in the earlier stages of growth, when it approximates in size to *L. minima.* I regret that I have no juv. examples of *perobliqua* for comparison. The other specimen mounted is *L. tatei.* It is a much smaller shell than the other, and does not seem to have been opened. It will be noticed, too, that on a careful reading of Woods's description it will not apply to this species.


(Fig. 12.)

Diplodonta tasmanica.
Pythina tasmanica.
Cardita atkinsoni.
Mytilicardia tasmanica.
Kellia atkinsoni.
Limopsis tenisoni.
Mytilus crassus.
Pecten mariæ.

I also take this opportunity to publish a figure of Rissoia rubicunda, Tate and May. It was overlooked when preparing the figures for the Revised Census. Fig. 13.


(Fig. 13.)

# SOME ADDITIONS TO THE BRYOLOGICAL FLORA OF TASMANIA.

BY W. A. WEYMOUTH.

## PART III.

*Read December 1st, 1902.*

The first and second parts of this series appeared in the Papers and Proceedings of the Royal Society of Tasmania for the years 1893 and 1894-5 respectively. They dealt only with mosses. The present paper includes both mosses and hepatics.

For the skilled determination of the mosses I am still indebted to the courtesy of Professor V. F. Brotherus, of Helsingfors, Finland, whose fourth and fifth parts of "Some New Species of Australian Mosses" furnish the description of new species that follow.

The hepatics have been very kindly determined by Herr F. Stephani, of Leipzig, through the courteous intervention of Dr. E. Levier, of Florence, who has rendered me great service in the preparation, submission, and return of my specimens.

Under the first of the following headings are given the original descriptions of five new mosses, and the names only of four others, bringing the total of new species added to Mr. R. A. Bastow's list of 1886 up to 37. The second heading covers eleven mosses already known elsewhere, but now first recorded for Tasmania.

The third part consists of new hepatics, numbering 17, the descriptions of which are, I am assured, in course of publication by Mr. Stephani in his elaborate work, "Species Hepaticarum," but are not now available to me.

The fourth part gives those hepatics which, while not new to science, are now newly recorded for Tasmania. These number no fewer than 92 species to be added to Bastow's enumeration in the Proceedings of this Society for 1887. It is interesting to note that of these one, *Acrobolbus piliferus*, is among Archer's Hepatics, but does not appear to have been noted locally; and a second, *Mastigobryum accretum*, doubtfully recorded as found by Gunn over 70 years ago, is now confirmed by Mr. Stephani on recent specimens.

### NEW MOSSES.

29. *Anomodon tasmanicus*, Broth., n. sp.

*Dioicus*; gracilis, caespitosus, caespitibus laxis, ochraceis; *caulis* secundarius flexuosus, hic illic ferrugineo-tomentosus, dense foliosus, superne subfasciculatim ramosus, ramis erecto-patentibus, haud complanatis, vix' ultra 1 cm altis, dense foliosis, simplicibus vel furcatis, obtusis; *folia* sicca laxe

**34. *Eriopus tasmanicus*, Broth., n. sp.**

*Dioicus*; gracilis, viridis, superne lutescenti-fuscescens, haud nitidis; *caulis* 2—3 cm altus, adscendens, superne arcuatus, complanatus, cum foliis 2,6—3 mm latus, inferne dense, superne parcius radiculosus, radiculis elongatis, fuscis, dense foliosus, subsimplex; *folia* sicca imbricata, humida planiuscula, *lateralia* erecto-patentia, obovata, apiculo acuto terminata, marginibus erectis, superne minutissime serrulatis, late limbata, limbo e seriebus 4—5 cellularum angustarum formato, nervis binis, brevissimis, altero saepe obsoleto, cellulis in medio folii ovali-hexagonis, 0,050—0,060 mm longis et c. 0,025 mm latis, superne sensim minoribus, basilaribus oblongo-hexagonis, *dorsalia* et *ventralia* adpressa, minora. Caetera ignota,

*Patria*. Tasmania, Hobart Waterworks, Gentle Annie, March, 1894. W. A. Weymouth.

Species *E. cristato* (Hedw.) Jaeg. affinis, sed statura multo minore foliisque minutius serrulatis, latius limbatis facillime dignoscenda.—*Brotherus's Australian Mosses*, V. p. 125.

35. *Fissidens leptòcladus*, C. Müll.-Broth., n. sp.

*Hab.*—Guy Fawkes Rivulet, near Hobart, on rocks, Sept., 1890, and Jan., 1897. W.A.W., Nos. 385, 2,157.

36. *Philonotis rigens*, Broth., n. sp.

*Hab.*—The Bridge Gully, near Glen Rae, Wattle Hill, Jan. 1891, W.A.W., No. 556.

37. *Weissia* (*Hymenostomum*) *Weymouthi*, C. Müll., n. sp.

*Hab.*.—On wet bank, Cradoc, Huon, Sept., 1889, W.A.W., No. 163.

### NEW VARIETIES.

3. *Acanthocladium extenuatum*, Brid., var. *rivuletorum*, Broth., n. var.

*Hab.* — West Coast, on the ground, banks of creeks, Macquarie Harbour, Nov., 1896. T. B. Moore (Herb. W.A.W., No. 2,069).

4. *Sphagnum Australe*, Mitt., var. *grandiosum*. Warnst., n. var.

*Hab.*—Huon, on old tramway, Arve Road, Franklin, W.A.W., No, 2,063.

### MOSSES NEW TO TASMANIA.

41. *Barbula unguiculata*, Hedw.

*Hab.*—New Town, on the ground in paddock Foster-street, March, 1893. W.A.W., No. 1,487.

42. *Bryum cupulatum*, C. Müll., f. *seta breviore.*

*Hab.*—Launceston streets, Aug, 1886. A. J. Taylor. (Herb. Bastow and W.A.W.)

43. *Bryum* (*Eubryum*) *laevigatulum*, Broth.

*Dioicum*; gracile, caespitosum, caespitibus densis, inferne ferrugineis, superne laete viridibus, nitidiusculis; *caulis* fertilis humilis, longe radiculosus, apice foliosus, innovationibus singulis vel binis, 1 cm altis, dense foliosis obtusis; *folia caulina* erecto-patentia, elongate oblonga, obtusiuscula, marginibus erectis, integerrimis, limbata, limbo e seriebus tribus cellularum composito, nervo crasso, rufescente, cum apice evanido, cellulis ovali-vel oblongo-hexagonis, basilaribus subrectangularibus, *innovationum* sicca imbricata, humida erecto-patentia, subcymbiformi-concava, oblonga, marginibus erectis, superne minutissime serrulatis, limbata, limbo triseriato, nervo cum apice evanido vel in apiculum erectum excedente, cellulis ovali-vel oblongo-hexagonis, basilaribus subrectangularibus; *bracteae perichaetii* internae foliis multo minores, lanceolatae, archegonia numerosa includentes; *seta* vix 1,5 cm alta, flexuosula, tenuis, purpurea; *theca* horizontalis vel nutans, pyriformis, collo sporangium aequante, sicca laevis, deoperculata sub ore haud constricta, demum rubra; *annulus* 0,10 mm latus, per partes secedens; *peristomium* duplex; *exostomii* dentes c 0,35 mm longi et c. 0,09 mm lati, lutei, apice hyalini, lamellis c. 20; *endostomium* liberum, sordide hyalinum, minute sed densissime papillosum; *processus* dentium longitudinis, carinati, anguste perforati; *cilia* rudimentaria; *spori* 0,015—0,017 mm, lutescentes, laevissimi; *operculum* convexo-conicum, apiculatum. Species *Br. laevigato* Hook. fil. Wils. affinis, sed statura multo minore et peristomio ciliis rudimentariis raptim dignoscenda.—*Broth. Australian Mosses,* IV., p. 88.

*Hab.*—New Town Falls, on rock, August, 1889. W.A.W., No. 1,845. Locality unrecorded. W.A.W., No. 1,849.

(Also New Zealand.)

44. *Campylopus Kirkii*, Mitt.

Dr. Brotherus says:—"That moss from Tasmania which my friend A. Geheeb, under the name of *Dicnemon Moorei*, Broth. Geh., mentions in Revue Bryologique, 1897, p. 67, I have by a further examination found to be *Campylopus Kirkii*, Mitt., earlier found in New Zealand."—Australian Mosses, IV., p. 74.

*Hab.*—West Coast, on the ground, Jones's Track, Macquarie Harbour. T. B. Moore (Herb. W.A.W., 2,015 b).

45. *Campylopus subappressifolius*, Broth. Geh.

*Hab.*—West Coast, Mount Darwin, damp places, alt. 3,400ft., March. 1893, T. B. Moore (Herb. W.A.W., No. 1,556); and on gravelly button-grass hills, Jones's Track, South Sprent River, T. B. Moore (Herb. W.A.W., No. 2,015).

46. *Hedwigia albicans* (Web.) Lindb.

*Hab.*—Hobart Rivulet, on dry rock, January, 1898, W.A.W., No. 2,167.

47. *Sphagnum centrale*, C. Jensen = S. intermedium, Russow.

*Hab.*—Brown's River, 1885, F. Abbott (Herbs. Bastow and W.A.W.). In a bog, Brown's River, 1894, C. D. Hazell (Herb. W.A.W., No. 1,915). Form *brachy-dasyclada*, R. A. Bastow, No. 531 (Herb. W.A.W.)

Var. *flavo-glaucescens*, Russ.

*Hab.*—Blue Tier Range, Sept., 1897, W. P. Kirwan (Herb. W.A.W., No. 2,123). Weldborough, Murphy's Creek, Aug., 1897 (f. *brachyclada*, Warnst.) P. H. Weymouth (Herb. W.A.W., No. 2,122).

Var. *fusco-pallescens*, f. *brachy-dasyclada*, Warnst.

*Hab.*—Weldborough, in a bog, Aug., 1897, W.A.W., No. 2,121.

Var. *flavo-pallescens*, f. *brachy-dasyclada*, Warnst.

*Hab.*—Blue Tier Range, Sept., 1897. W. P. Kirwan (Herb. W.A.W., No. 2,124).

48. *Sphagnum cuspidatum* (Ehrh.)

Var. *submersum* (Schimp.), f. *serrulata* (Schlieph).

*Hab.*—West Coast, floating in water of sandy ditch, West Strahan, Oct., 1893, W.A.W., No. 2,063.

49. *Tortula panduræfolia*, Hpe. C.M.

*Hab.*—Mount Rumney, Nov., 1885. R. A. Bastow (Herb. W.A.W.) On stone, behind Knocklofty, near Hobart, Jan., 1888, W.A.W., No. 1577.

50. *Ulota fulva*, Brid.

*Hab.*—West Coast, on wood, Comet-Dundas road, Oct., 1893, W.A.W., No. 1,654.

51. *Zygodon obtusifolius*, Hook.

*Hab.*—West Coast, on trees, Sophia Point, Macquarie Harbour, T. B. Moore, No. 26 (Herb. W.A.W., No. 1,999).

## New Hepatics.

1. *Aneura dentata,* Steph., n. sp., 1899. Species Hepaticarum I.

*Hab.*—Lottah, on wet bank, August, 1897, W.A.W. (a few admixed fragments); and St. Crispin's, Mt. Wellington, on rocks, Jan., 1899, W.A.W., Nos. 570, 572-574.

2. *Aneura gracilis,* Steph, n. sp., 1899. Species Hepat. I.

*Hab.*—Guy Fawkes Rivulet, near Hobart, Jan., 1897, W.A.W.; Deep Creek and Bower Creek, Mt. Wellington, alt. 1,600ft., Dec., 1897; Hobart Rivulet, Jan., 1898; St. Crispin's, on tree fern and on face of wet rocks, alt. 2,200ft., and Watchorn's Hill, on bank of watercourse near State-school, Jan., 1899, W.A.W., Nos. 252a, 296/7, 309, 328, 363, 369, 434, 566, 568.

3. *Aneura longiflora,* Steph., n. sp., 1899. Species Hepat. I.

*Hab.*—Blue Tier near Lottah, Aug., 1897, and Bower Creek, Mount Wellington, alt. 2,000ft., Dec., 1897, W.A.W., Nos. 208, 210, 360.

4. *Aneura tasmanica,* Steph., n. sp., 1899. Species Hepat. I.

*Hab.*—Guy Fawkes Rivulet, on wood, Sept., 1892, and Jan., 1898; Deep Creek, on stony bank, alt. 1,600ft., Dec., 1897; and Bower Creek, on wet rock, Dec., 1898, W.A.W., Nos. 228, 252, 307, 428. Locality unrecorded, R. C. Gunn (Herb. Mitten and Hobart Museum).

Of Gunn's specimen, which was marked *Sarcomitrium crassum* by Mr. Mitten, Herr Stephani writes:—"*Aneura* "*crassa* (Schwgr.) Nees is not to be found in any European "collection. It is reported to be collected 'in the Australian "Islands.' Such a vague expression does not permit us to "consider Gunn's plant as a reliable original. See my "*Species Hepat.* I., p. 274."

5. *Cephalozia verrucosa,* Steph., n. sp., 1899. Species Hepat. I.

*Hab.*—On the Cataract Hill, Launceston, July, 1899, W.A.W., No. 694.

6. *Cephaloziella Levieri,* Steph., n. sp., 1899.

*Hab.*—Deep Creek, on stony bank (a few scraps with *Lepidozia glauca,* Steph.), alt. 1,600ft., Dec., 1897, W.A.W., No. 316 in part.

7. *Cheilolejeunea Weymouthi,* Steph., n. sp., 1899.

*Hab.*—Hobart Rivulet, on wet rock on margin, Nov., 1898, W.A.W., No. 403.

8. *Fimbriaria tasmanica*, Steph., n. sp., 1899.

*Hab.*—Beltana, on the Recreation Ground, June, 1899, and Launceston, on Trevallyn Hills, July, 1899, W.A.W., Nos. 672, 711, 714, 716.

9. *Fossombronia dentata*, Steph., n. sp., 1897.

*Hab,*—Launceston, on earth, Trevallyn, Sept., 1892, W.A.W., No. 13.

10, *Isotachis pusilla*, Steph., n. sp., 1899.

*Hab*—Longley, on roadside bank, Huon-road, May, 1899, W.A.W., No. 649.

11. *Lejeunea* (*Eulejeunea*) *cuspidistipula*, Steph., n. sp., 1899.

*Hab.*—Mount Wellington, on live tree trunk (on *Zygodon* sp.), 25th Dec., 1897, alt. 2,500ft., W.A.W., No. 412.

12. *Lepidozia sexfida*, Steph., n. sp., 1899.

*Hab.*—Huon-road, on roadside bank, Longley, May, 1899, W.A.W., No. 650/1. North and South Upper Huon, on roadside banks, May, 1899, W.A.W., Nos. 652, 654/5, 660, 663.

13. *Lophocolea Weymouthi*, Steph., n. sp., 1899.

*Hab.*—Mount Wellington, Bower Creek, on trunk of tree fern, and on rocks, Dec., 1898, and St. Crispin's, on decayed wood, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 420, 421, 565.

14. *Plagiochila squarrosa*, Steph., n. sp., 1900.

*Hab.*—On rock, Newman's Creek, Tasman Peninsula, Feb. 1899, W.A.W., No. 819.

15. *Radula Weymouthi*, Steph., n. sp., 1899.

*Hab.*—On decaying sassafras branch, Wellard Rivulet, Tasman Peninsula, Feb., 1899, W.A.W., No. 628.

16. *Riccia tasmanica*, Steph., n. sp., 1899.

*Hab*—Beltana, River Derwent, on the ground, June, 1899, W.A.W., No. 674 *ex parte*.

17. *Tylimanthus homomallus*, Steph., n. sp., 1897.

*Hab.*—Blue Tier, Dec., 1895, E. McGregor (few specimens picked out—Herb. W.A.W.)

### HEPATICS NEW TO TASMANIA.

1. *Acrobolbus piliferus* (Mitt. sub *Gymnanthe*), Schiffn.

*Hab.*—No locality or date recorded, W. Archer.

In Archer's Herbarium, Hobart Museum, there is a specimen named by Mitten *Gymnanthe pilifera*, but it does not appear to have been previously recorded for Tasmania.

2. *Acrobolbus unguiculatus* (Hook. *f.* Tayl.), Mitt.

*Hab.*—South Upper Huon, on bank of roadside ditch, May, 1899, W.A.W., 659, 662 *b.*

3. *Anastrophyllum schismoides* (Mont.), Steph.

*Hab.*—Blue Tier, Dec., 1895, E. McGregor. Herb. W.A.W., No. 195.

4. *Aneura Colensoi*, Steph. Species Hepat. I.

*Hab.*—Hobart Rivulet, on damp earth at margin of stream, Jan., 1898, W.A.W., Nos. 362, 366.

5. *Aneura erecta*, Steph. Species Hepat. I.

*Hab.*—Mount Wellington, on wood, Deep Creek, Dec., 1887, Bower Creek, Jan., 1888, on rock St. Crispin's, Jan., 1899, W.A.W., Nos. 406 in part, 569.

6. *Aneura minima*, Carr. Pears.

*Hab.*—Mount Wellington, on a tree St. Crispin's, Dec., 1895; on wet bank, Falls Track, Nov., 1896, W.A.W., Nos. 108, 179, 181, 207.

7. *Aneura nitida*, Colenso.

*Hab.*—Mount Wellington, on decayed wood St. Crispin's, Dec., 1895, W.A.W., No. 105.

8. *Aneura perpusilla*, Colenso.

*Hab.*—Tasman Peninsula, on decayed wood, Wellard Rivulet, Feb., 1899, W.A.W., No. 804.

9. *Aneura polymorpha*, Colenso.

*Hab.*—Hobart, on earth, Salvator Rosa Glen, W.A.W., No. 129 (b). Mount Faulkner, on bank of creek near Skye Farm, Dec., 1892, Mrs. Pettifer (Herb. W.A.W., No. 188).

10. *Aneura prehensilis* (Hook. *f.* Tayl.), Mitt.

*Hab.*—Mount Wellington, on log, Bower Creek, Dec., 1898, W.A.W., No. 431.

11. *Aneura stolonifera*, Steph. Species Hepat. I.

*Hab.*—Tasman Peninsula, 1893, Rev. John Bufton (Herb. W.A.W., 399). Mount Wellington, on wet bank Falls Track, Nov., 1896, W.A.W., No. 415.

12. *Anthoceros carnosus* (Hook. *f.* Tayl.), Steph. Species Hepat. I.

*Hab.*—Mount Wellington, on wet rocks Deep Creek, Dec., 1887, on rocks near the Springs, Dec., 1890 and 1894, W.A.W., Nos. 54, 54 (b) 55.

13. *Anthoceros crassus*, Steph.

*Hab.*—Western Rivulet, W. Archer. (Herb. Archer in Hobart Museum.)

14. *Cephalozia exiliflora* (Tayl.), Steph.

*Hab.*—Mount Wellington, on wood Deep Creek, alt. 1,600ft., Dec., 1887, and Geeveston, on burnt log, Nov., 1892, W.A.W.

15. *Chandonanthus squarrosus* (Hook.), Mitt.

*Hab.*—Mount Wellington, on the Springs Track, alt. 2,000ft., Nov., 1890, W.A.W., No. 73.

16. *Cheilolejeunea muscicola*, Steph. Species Hepat.

*Hab.*—Hobart Rivulet, on rocks in running water, Jan., 1898, W.A.W., No. 373.

17. *Chiloscyphus affinis*, Gottsche.

*Hab.*—River Mersey, on shady earth bank near Latrobe Waterworks, March, 1893, W.A.W., and Mount Wellington, on wet rock in Bower Creek, Dec., 1898, W.A.W., No. 426.

(Also Australian Alps, F. v. M.)

18. *Chiloscyphus asperrimus*, Steph. Species Hepat.

*Hab.*—West Coast, Moore's Track to Frenchman's Cap, T. B. Moore. (A few fragments picked out.)

19. *Chiloscyphus commutatus*, Steph. Species Hepat.

*Hab.*—Tasman Peninsula, on shady rocks, and on wet decayed wood, Newman's Creek, W.A.W., Nos. 604, 612.

20. *Chiloscyphus cuneistipulus*, Steph. Species Hepat.

*Hab.*—Mount Wellington, Deep Creek, Dec., 1887, alt. 1,600ft., W.A.W., No. 97 (a few specimens).

21. *Chiloscyphus ligulatus*, Colenso.

*Hab.*—Franklin, Price's Rivulet, Feb., 1892, W.A.W., No. 50. Mount Wellington, on wet rocks Guy Fawkes Falls, Sept., 1892, and St. Crispin's, alt. 2,200ft.. Dec., 1895, and on face of dripping rocks Hobart Rivulet, Aug., 1896, W.A.W., 49, 115, 117.

22. *Chiloscyphus Moorei*, Steph. Species Hepat.

*Hab.*—West Coast, on Jones's Track, and on hard button-grass plains, Macquarie Harbour, Nov., 1896, T. B. Moore. (Herb. W.A.W., Nos. 150, 168.)

23. *Chiloscyphus Mülleri,* Gottsche.

*Hab.*—D'Entrecasteaux Channel, on wet bank of roadside drain, Middleton, Aug., 1894, W.A.W., 178.

(Also Australian Alps, F. v. M.)

24. *Chiloscyphus odoratus,* Mitt.

*Hab.*—Mount Wellington, on wood Deep Creek, alt. 1,600ft., Dec., 1887, W.A.W., No. 53.

25. *Chiloscyphus physanthus* (Tayl.), Mitt.

*Hab.*—Mount Wellington, Deep Creek, Dec., 1887 (fragments with other hepatics), W.A.W., and Guy Fawkes Rivulet, May, 1890, W.A.W., No. 184.

26. *Chiloscyphus trispinosus,* Mitt.

*Hab.*—Tasman Peninsula, on wood. Newman's Creek. March, 1891, W.A.W. (picked out from *Tricholea tomentella*),

27. *Fossombronia perpusilla* (Col.), Steph.

*Hab.*—Launceston, on earth, Trevallyn Hill, Sept., 1892, W.A.W., Nos. 389, 395.

28. *Frullania cinnamomea,* Carr. et Pears.

*Hab.*—Tasman Peninsula, on fallen sassafras, Newman's Creek, Feb., 1899, and Launceston, on rock, Cataract Hill, July, 1899, W.A.W., Nos. 776, 705.

29. *Frullania cranialis,* Tayl.

*Hab.*—Mount Wellington, on trunk of *Prostanthera,* Deep Creek Track alt. 1,600ft., Jan., 1899, W.A.W., Nos. 580, 582.

30. *Frullania pentapleura,* Tayl.

*Hab.*—Kempton, on rock on the Sugar Loaf, May, 1892, and Mount Wellington, on a tree, St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 217, 581.

31. *Frullania pycnantha,* Tayl.

*Hab.*—Launceston, on rock, Cataract Hill, July, 1899, W.A.W., Nos. 706, 707.

32. *Frullania spinifera,* Tayl.

*Hab.*—Guy Fawkes Rivulet, near Hobart, on trunk of tree, Jan., 1899, and Tasman Peninsula, on English oak, Carnarvon, Feb., 1899, W.A.W., Nos. 473, 476, 477, 775.

33. *Hymenophyton leptopodum* (Tayl.) Dum.

*Hab.*—Mount Wellington, Deep Creek, Dec., 1887, on wood, Guy Fawkes Rivulet, Jan., 1897, on rock and roots. Hobart Rivulet, Jan., 1899, on wet rocks St. Crispin's, Jan., 1899, W.A.W., Nos. 124, 457, 458, 460, 563 (in part).

34. *Hymenophyton podophylla*, Nees et Mont.

*Hab.*—Mountains towards Lake Pedder, Schuster, 1875, with f. flowers.—*Frag. Phyt. Aus. XI.*, p. 67 (supplement).

35. *Isotachis grandis*, Carr. et Pears.

*Hab.*—Mount Wellington, on top, amongst *Sphagna*, Feb., 1888, alt. 4,166ft., W.A.W., No. 57. West Coast, Sophia Point, Macquarie Harbour, T. B. Moore (Herb. W.A.W., No. 131).

36. *Isotachis inflexa*, Gottsche.

*Hab.*—Huon-road, on roadside bank near the Halfway Bridge at Longley, Feb., 1892, W.A.W., No. 401.

(Also Blue Mountains, N.S.W., 1871, W. Woolls.)

37. *Lejeunea* (*Eulejeunea*) *Drummondi* (Tayl.).

*Hab.*—River Mersey, on trunk of tree near Latrobe Waterworks, March, 1893, W.A.W., No. 125. Guy Fawkes Rivulet, near Hobart, on *Prostanthera*, Jan., 1899, W.A.W., Nos. 469, 482. Tasman Peninsula, on rocks Newman's Creek, and on wood Wellard Rivulet, Feb., 1899, W.A.W., Nos. 613, 629.

38. *Lepicolea attenuata* (Mitt.) Spruce.

*Hab.*—Mount Wellington, Wellington Falls, March, 1886, R. A. Bastow (Herb. W.A.W., 66*d*). On rocks, Sept., 1891, and near the Organ Pipes, Dec., 1894, W.A.W., Nos. 186, 198. West Coast, Comet-Dundas Road, Grubb's Tramway, Zeehan, and West Strahan, Oct., 1893, W.A.W., Nos. 66, 66*b&c.* Blue Tier, Dec., 1895, E. McGregor, and Sept., 1897, W. P. Kirwan (Herb. W.A.W., No. 214.) West Coast, Macquarie Harbour, Nov., 1896, T. B. Moore (Herb. W.A.W., No. 167.)

39. *Lepidozia asymmetrica*, Steph.

*Hab.*—Mount Wellington, Deep Creek, Hobart Rivulet, and Bower Creek, Dec., 1897, Jan. and Dec., 1898, W.A.W., Nos. 281, 345, 364, 406*b*. North Upper Huon, on roadside bank, May, 1899, W.A.W., No. 653.

40. *Lepidozia chætophylla*, Spruce.

*Hab.*—Tasman Peninsula, on tree fern, Wellard Rivulet, Feb., 1899, W.A.W., 808.

41. *Lepidozia chordulifera*, Tayl.

*Hab.*—West Coast, Jones's Track, T. B. Moore. (Herb. W.A.W., No. 135.)

42. *Lepidozia concinna*, Colenso.

*Hab.*—Mount Wellington, St. Crispin's, Jan., 1899, W.A.W., No. 591*b*, alt. 2,200ft.

43. *Lepidozia glauca*, Steph.

*Hab.*—Mount Wellington, Deep Creek, alt. 1,600ft., Dec., 1897, W.A.W., No. 316.

44. *Lepidozia magellanica*, Steph.

*Hab.*—Tasmania, locality not recorded, W.A.W.

45. *Lepidozia parvitexta*, Steph.

*Hab.*—Mount Wellington, Bower Creek, alt. 1,500ft., and St. Crispin's, alt. 2,200ft., Jan., 1888, Nov., 1890, Dec., 1895, W.A.W., Nos. 3, 67, 106. West Coast, Macquarie Harbour, July, 1893, and Nov., 1896, T. B. Moore (Herb. W.A.W., Nos. 132, 166). Blue Tier, Dec., 1895, E. McGregor.

46. *Lepidozia Saddlensis*, Massalongo.

*Hab.*—West Coast, Mount Darwin (amongst *Symphyogyna obovata*, 1893, T. B. Moore. (Herb. W.A.W., No. 381.)

47. *Lepidozia setiformis*, De Notaris.

*Hab.*—Sandfly Road, near Ludbey's, Dec., 1888, W.A.W., No. 410 (a few fragments).

48. *Lophocolea allodonta*, Mitt.

*Hab.*—Port Esperance, on wood, main road, W.A.W., No. 46. Mount Wellington, East Slope and Bower Creek, Dec., 1897, W.A.W., Nos. 261, 350, 356. Tasman Peninsula, on tree, Wellard Rivulet, Feb., 1899, W.A.W., No. 816 in part.

49. *Lophocolea alternifolia*, Mitt.

*Hab.*—Mount Wellington, on fallen branches of trees, Bower Creek, Dec., 1897, W.A.W., No. 343.

50. *Lophocolea australis*, Gottsche.

*Hab.*—West Coast, Porteus's Gully, Queen River Road, Feby., 1891, W.A.W., No. 94 (few fragments) Mt. Wellington: on wet rock in Bower Creek, Dec., 1898; on stony bank, Deep Creek Track, near Trolly hut, Jan., 1899; on rock Watchorn's Hill, Jan,, 1899. W.A.W., Nos. 418, 496, 511,

51. *Lophocolea bispinosa* (Hook. f Tayl.) Mitt.

*Hab.*—Hobart Rivulet, Dec., 1897, and Jan., 1898. Mt. Wellington, on the Springs Track, and on rocks Deep Creek, Dec., 1897; on rock in Bower Creek, Dec., 1898; and on rock St. Crispin's, Jan., 1899. New Town Rivulet, June, 1899. W.A.W., Nos. 241, 274, 302/3, 372, 427, 515/6, 519, 521, 719.

52. *Lophocolea Bridelii*, Gottsche.

*Hab.*—Blue Tier, Sept., 1897, W. P. Kirwan (Herb. W.A.W.). Mt. Wellington, on rock Deep Creek, Dec., 1897; on rock and native laurel St. Crispin's; on Deep Creek track, and at Watchorn's Creek, Jan., 1899. W.A.W., Nos. 304, 493, 514, 517, 575.

53. *Lophocolea Campbelliana*, Steph. Species Hepat.

*Hab.*—Hobart Rivulet, Dec., 1892. W.A.W. (amongst *Dicranum*).

54. *Lophocolea corticola*, Steph. Species Hepat.

*Hab.*—Mt. Wellington, on rock St. Crispin's, Jan., 1899, W.A.W., No. 558. Tasman Peninsula, on wet decayed wood Newman's Creek, and on decayed wood Wellard Rivulet, Feb., 1899, W.A.W., Nos. 606, 608.

55. *Lophocolea erectifolia*, Steph. Species Hepat.

*Hab.*—Mount Wellington, St. Crispin's, Dec., 1895, W.A.W., No. 111.

56. *Lophocolea Lauterbachii*, Steph.

*Hab.*—Tasman Peninsula, on a tree Wellard Rivulet, Feb., 1899, W.A.W., Nos. 564 in part, 802.

57. *Lophocolea Moorei*, Steph. Species Hepat.

*Hab.*—West Coast, on track to Frenchman's Cap, 1893 (amongst *Radula plicata*), T. B. Moore (Herb. W.A.W., No. 138). Huon-road, on wood Millhouse's Falls, March, 1893, W.A.W., No. 92. Mount Wellington, on wood St. Crispin's, Dec., 1895, and Jan., 1899, and on stony bank Deep Creek, Dec., 1897, W.A.W., Nos. 280/1, 502/3.

58. *Lophocolea multipenna*, Tayl.

*Hab.*—West Coast, King River, T. B. Moore (Herb. W.A.W., No. 163); on wood near Leslie Junction, Dundas, Oct., 1893 (amongst *Plagiochila ramosissima*), W.A.W., No. 767. Mount Wellington, on rocks in running water, St. Crispin's, Jan., 1899, W.A.W., No. 513.

59. *Lophocolea planiuscula*, Tayl.

*Hab.*—Franklin, Huon, on old tramway Price's Rivulet, Feb., 1892, W.A.W., No. 119. Mount Wellington, Falls Track, Nov., 1896, W.A.W., No. 202.

60. *Lophocolea rotundistipula*, Steph. Species Hepat.

*Hab.*—Mount Wellington, on boulders in running water, St. Crispin's, alt. 2,200ft., W.A.W., No. 107.

61. *Lophocolea rupicola*, Steph.

*Hab.*—Mount Bischoff, on stone River Waratah, April, 1892, W.A.W., No. 187.

62. *Lophocolea submarginata*, Tayl.

*Hab.*—Mount Wellington, Bower Creek, Dec., 1897 (mixed with *Hymenophyton phyllanthus*), W.A.W.

63. *Lophocolea subporosa*, Tayl.

*Hab.*—Mount Wellington, on decayed wood, Bower Creek, Dec., 1897 (a few admixed fragments), W.A.W.

64. *Lunularia cruciata* (L.) Dum. = *L. Vulgaris*, Micheli.

*Hab.*—On the ground, Mona Vale, near Ross, August, 1899, W.A.W., 862.

65. *Marchantia cephaloscypha*, Steph. Species Hepat.

*Hab.*—Mount Wellington, north slope, Jan., 1888, W.A.W., No. 130. Hastings, on Hay's tramway, April, 1888, W.A.W., No. 130*b*. Latrobe, on the ground, Hazeldean, March, 1893, and Tasman Peninsula, on the ground near Brown Mountain, Jan., 1899, W.A.W., Nos. 128, 756. Gould's Country, Jan., 1897, Mrs. W. A. Weymouth (Herb. W.A.W., No. 206). Derwent Valley, Back River Creek, Dec., 1898, Miss Jean Downie (Herb. W.A.W., No. 446).

66. *Marchantia fusca*, Steph., Bull. Herb. Boiss., 1899.

*Hab.*—Mount Wellington, on wet bank Deep Creek, alt. 1,600ft., Dec., 1897, and on wet bank in bed of Bower Creek, alt. 2,000ft., Dec., 1898, W.A.W., Nos. 306, 447/8.

67. *Marsupidium setulosum*, Mitt.

*Hab.*—Mount Faulkner, on dry rocks near Skye Farm, Dec., 1892, W.A.W. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., No. 453).

68. *Mastigobryum accretum*, Lehm. Ldnbg.

*Hab.*—West Coast, on wood Grubb's Tramway, Zeehan, Oct., 1893, W.A.W., No. 229. Also near Leslie Junction, Dundas, Oct., 1893, W.A.W., No. 767 in part (a scrap). Dr. Levier says of this plant:—"Highly interesting. . . Mr. "Stephani writes that *Mastigobryum accretum*, an Australian "species not found in Tasmania since 1830, and quoted with "doubt, is now perfectly sure."

69. *Mastigobryum elegans*, Colenso.

*Hab.*—Mt. Wellington, St. Crispin's, Jan., 1888, W.A.W., No. 4. Blue Tier, Dec., 1895, E. McGregor.

70. *Mastigobryum Mittenii*, Steph. Species Hepat.

*Hab.*—Port Esperance, Aug., 1887, D. Purvis (Herb. W.A.W., 226.) Lymington (Port Cygnet), Sept., 1887, Rev. F. C. B. Fairey (Herb. W.A.W., 223). Mount Wellington, Springs Track, Dec., 1890; Deep Creek, Dec., 1893 and 1897, on a log St. Crispin's, Jan., 1899, W.A.W., Nos. 224/5, 227, 319, 532. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W.). West Coast, Moore's Track to Frenchman's Cap, T. B. Moore (Herb. W.A.W., 136); North-East Dundas, Oct., 1893, Miss C. Page. Weldborough, 1897, Gilbert Murphy (Herb. W.A.W., 487). Tasman Peninsula, Rev. John Bufton (Herb. W.A.W., 400); on decayed wood and on sassafras Wellard Rivulet, W.A.W., Nos. 642/3.

71. *Mastigobryum mooreanum*, Steph. Species Hepat.

*Hab.*—West Coast, Jones's Track, North Sprent River, T. B. Moore (Herb. W.A.W., 147).

72. *Metzgeria atrichoneura*, Spruce.

*Hab.*—Tasman Peninsula, amongst *Tylimanthus tenellus*, Wellard Rivulet, Feby., 1899, W.A.W., 761 in part.

73. *Metzgeria nitida*, Mitt. = *M. Australis*, Steph.

*Hab.*—Mount Wellington, Deep Creek, Dec., 1887; St. Crispin's, Dec., 1895; Bower Creek, Dec., 1897, and elsewhere, W.A.W., Nos. 27, 29, 32, 110, 242, 267, 462, etc. West Coast, Frenchman's Cap, and Jones's Track to Huon, T. B. Moore (Herb. W.A.W., Nos. 142, 146). Tasman Peninsula, on wood, Wellard Rivulet, Feby., 1899, W.A.W., *Nos. 769, 784,* 801.

74. *Metzgeria saccata*, Mitten.

*Hab.*—Mount Wellington, on *Orthotrichum tasmanicum*, growing on a falling branch, alt. 2,500ft., Dec., 1897, W.A.W., No. 407. Tasman Peninsula, on sassafras, Wellard Rivulet, Feb., 1899, W.A.W., No. 782 in part.

75. *Odontoschisma sp.* (incomplete).

*Hab.*—Launceston, on wood Trevallyn Gully, off First Basin, Jan. 1888, W.A.W., No. 42. West Coast, Jones's Track, T. B. Moore (Herb. W.A.W., No 154).

76. *Plagiochila apiculata*, Steph.

*Hab.*—Mount Wellington, on a bank St. Crispin's Track, on rocks St. Crispin's, and on rock Deep Creek Track, Jan, 1899, W.A.W., Nos. 542, 549, 551/2, 555.

77. *Plagiochila fuscella*, Tayl. (?—incomplete).

*Hab.*—Emu Bay, Jan., 1892, J. H. Royce (Herb. W.A.W., No. 68).

78. *Plagiochila incurvicolla* (Hk. f. Tayl.)

*Hab.*—Mount Wellington, Fork Creek, Oct., 1888, W.A.W. Hobart Rivulet, Dec., 1897, W.A.W., No. 245.

79. *Plagiochila intertexta* (Hk. f. Tayl).

*Hab.*—Mount Wellington, east slope, alt. 2,500ft., Dec., 1897, W.A.W., No. 270.

80. *Plagiochila Kingiana*, Gottsche.

*Hab.*—Hobart Rivulet, on damp earth at margin of stream, Jan., 1898, W.A.W., No. 365.

81. *Plagiochila pleurota* (Hk. f Tayl.)

*Hab.*—Mount Wellington, on sassafras Bower Creek, Dec., 1897, W.A.W., No. 339.

82. *Plagiochila ramosissima*, Lindenberg.

*Hab.*—West Coast, on wood near Leslie Junction, Dundas, Oct., 1893, W.A.W., No. 767.

83. *Plagiochila Taylori*, Steph.

*Hab.*—Mount Wellington, on rock in bed of Bower Creek, Dec., 1898; on rocks in running water, Millhouse's Creek; on rocks St. Crispin's, and on rock Deep Creek, Jan., 1899, W.A.W., Nos. 439, 545, 548, 550, 553/4.

84. *Plagiochila Traversii*, Gottsche.

*Hab.*—Hobart Rivulet, Dec., 1897, W.A.W., No. 247.

85. *Radula Mitteni*, Steph. Species Hepat.

*Hab.*—Guy Fawkes Rivulet, Nov., 1891; Jan., 1898; on rock Jan., 1899. Huon Road, Millhouse's Falls, March, 1893; Mt. Wellington, Bower Creek, Dec., 1898, W.A.W., Nos. 21, 90/1, 251, 425, 443. Tasman Peninsula, on shady rock Newman's Creek, on decayed wood and on musk Wellard Rivulet, Feby., 1899, W.A.W., Nos. 623, 625, 627, 630.

86. *Radula plicata*, Mitt.

*Hab.*—Mount Wellington, Bower Creek, Jan., 1888; New Town Falls, Aug., 1889, W.A.W., Nos. 1, 88. Port Cygnet, Homedale Gully, Sept., 1889, W.A.W., No. 9. Tasman Peninsula, Wellard's Track, Mch., 1891, W.A.W., No. 185. West Coast, Strahan West, Oct., 1893, W.A.W., No. 172. Blue Tier, Dec., 1895, E. McGregor (amongst *Lophocolea Moorei*).

87. *Saccogyna australis*, *Mitt.*

*Hab.*—Huon Road, Longley, at base of wet rocks near Bridge, Nov., 1892 (amongst *Sphagnum australe*), W.A.W. West Coast, Moore's Track to Frenchman's Cap (fragments amongst *Chiloscyphus asperrimus*), T.B. Moore (Herb. W.A.W.).

88. *Schistochila (?) Spegazziniana*, Massalonga.

*Hab.*—Macquarie Harbour, Birch Inlet, Nov., 1896. T. B. Moore, No. 185 (Herb. W.A.W, 169). Sterile.

89. *Symphyogyna interrupta*, Carr. Pears.

*Hab.*—Mount Wellington, Bower Creek, Jan., 1888, W.A.W., No. 23.

90. *Tylimanthus brecknockiensis* (Massalongo, Hep. Fueg., 1895, cum icone, sub-Adelantho), Steph.

*Hab.*—Mount Wellington, Deep Creek, alt. 1,600ft., Dec., 1887 (amongst Hymenophyton), and Dec., 1897; on rock East Slope, Dec, 1897; on wet rock and on wood St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 278, 283, 259, 563, 594. Huon-road, Millhouse's Creek, March, 1893, W.A.W., No. 122. Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., 193). West Coast, Gordon River, T. B. Moore (Herb, W.A.W., 165).

91. *Tylimanthus crystallinus* (Massalongo, Hepat. Fueg., sub-*Gymnanthe*, 1885, p. 238, tab. 22), Steph.

*Hab.*—Blue Tier, Dec., 1895, E. McGregor (Herb. W.A.W., 194). West Coast, Mount Darwin, T. B. Moore (Herb. W.A.W., 152).

92. *Tylimanthus perpusillus*, Colenso.

*Hab.*—Mount Wellington, on rock and wood St. Crispin's, alt. 2,200ft., Jan., 1899, W.A.W., Nos. 533/4.

# TRACHYDOLERITE IN TASMANIA.

By W. H. TWELVETREES, F.G.S., Government Geologist.

[Read 1st December, 1902.]

IN 1889 evidence was laid before this Society by Mr. W. F. Petterd and myself, demonstrating the existence in Tasmania of two centres or districts characterised by eruptive rocks derived from elæolitic and theralitic magmas.

I now submit further localities for rocks belonging to the same great felspathoid series. One of these is the Table Cape Bluff, near Wynyard, on the North-West Coast, and another is the Nut at Circular Head. A third is One Tree Point, Sandy Bay, near Hobart, where melilite basalt has been identified, but only the first two will be dealt with in these notes.

The tertiary basaltic rock which forms the headland near Wynyard came many years ago under the notice of the late Professor Ulrich, who thought at the time that he could recognise the small water-clear hexagons which are abundantly visible in prepared slides as sections of the felspathoid mineral nepheline. Both my colleague and I were, on the other hand, disposed to diagnose the mineral as apatite, and we learned from the lamented Professor shortly before his death that he had arrived at the same opinion. Mr. Thos. Stephens often communicated to me his idea that this coarsely crystalline rock was a distinct flow from our common olivine basalt. The mere difference in texture did not appear to me a valid reason for assuming any further difference between the two rocks. However, in drawing up a classification scheme, the occurrence of a dyke of limburgite on the Emu Bay Railway Line, nine miles from Burnie, led me to hesitate, in view of the fact that Rosenbusch classes limburgite as belonging to the theralitic magmas. Renewed examination of the doleritic rock at Table Cape and Circular Head showed the presence of a felspathoid. The optical tests were confirmed by staining, and a specimen was sent Home to Professor Rosenbusch It was referred by him to trachydolerite, the effusive form of essexite. I wish here to acknowledge the readiness with which the professor has always aided in solving difficulties in Tasmanian petrology. His letter reads as follows:—"The compact basaltic rock of the Table Cape Bluff and Circular Head is best referred to the trachydolerite group. Besides labradorite, augite, olivine iron ore, and abundant apatite, it contains a colourless mineral with a very low refractive index and abnormal double refraction, which gelatinises in weak acid and allows much $Na_2O$ to go into solution. I regard it as analcime. It is always allotriomorphic, and it is highly probable that this mineral is derived from nepheline. In a special slice which I prepared I saw distinctly in an isotropic spot the interference figure of a negative uniaxial mineral (nepheline)."

The hornblende, haüyne, and sphene, which are common in typical trachydolerite, are absent, so the rock is not a normal member of the family.

In the Table Cape rock, olivine is abundant as phenocrysts; augite as prisms, also in grains of the second generation; labradorite in slender twinned prisms; apatite in vertical and hexagonal sections, iron ores in numerous grains and cubes. There is a great deal of the feebly refractive analcime in plates of extreme tenuity. In some slides thin rectangular sections of the mineral determined by Professor Rosenbusch as nepheline are present.

In the Circular Head rock, the augite is in larger crystals and plates, and exceeds the olivine in quantity. It is the violet-tinted variety of diopside so common in nepheline-bearing rock. Apatite is abundant in the slides in the form of short columns, spindle-shaped, or hexagonal sections. Titaniferous iron or magnetite has separated out. The interstitial groundmass abounds with microlites and with isotropic or feebly refractive material. It is apparently saturated with analcime, and in one instance natrolite could be detected.

The macroscopic aspect of these rocks is doleritic. The Circular Head variety is somewhat coarser in grain than that of Table Cape.

Briefly, the abundance of apatite and analcime warn us that we are not dealing with an ordinary basalt, and the presense of nepheline, in however small quantity, confirms this belief.

It is difficult to suggest what relation the rock of these Bluff bears to the ordinary Tertiary olivine basalt of the coast. Both are of Tertiary age, but each is the product of a different magma, and such rocks hitherto have not been found associated. The two families would be represented as under—

Normal olivine basalt | Trachydolerite
|
Diabase (Dolerite)
|
Gabbro | Essexite (not yet discovered)

The term trachydolerite here has not the original sense in which it was used in 1841 by Abich, who understood by it a basic trachyte or a rock intermediate between trachyte and basalt. Its alkali percentage is high, viz.—6 to 11%, against the usual 3% or 4% in ordinary basalt. The variety of constitution points strongly to essexite parentage, and as essexite occurs physically connected with elæolite syenite, so trachydolerite is associated with alkali trachytes, phonolites, tephrites, &c. Its sp. gr. is 2·86.

Professor F. Loewinson-Lessing differs from this Rosenbuschian view, and ranges trachydolerite among monzonitic magmas, and not among essexitic ones.* He treats it as equivalent to ciminite (Washington), a passage rock between basalt and trachyte, and would suppress ciminite in its favor or in favor of "trachyte basalt." It is, then, considered the effusive equivalent of gabbro syenite or monzonite. But, as there is reason to regard the basic syenite known as monzonite as being not so much a passage rock between syenite and gabbro, as between normal syenite and alkali syenite, so trachydolerite must be looked upon as intermediate, not between normal basalt and trachyte, but between tephrite and alkali trachyte. The occasional presence in it of haüyne, sodalite, barkevikitic hornblende, anorthoclase, leucite, and ægirine points to the alkali magma.

It is possible that some of our other Tertiary basalts may, on closer examination, prove to be trachydoleritic; and the eventual discovery of the parent plutonic rock, essexite, is probable.

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* Kritische Beiträge zur Systematik der Eruptivgesteine: Tschermak's min. u. petrogr. Mittheilungen xix. 1900. iv. p. 303.

# ON CERTAIN CALCAREOUS NODULES.

By Professor E. G. Hogg, M.A.

[Read 1st December, 1902 ]

[Two photos.]

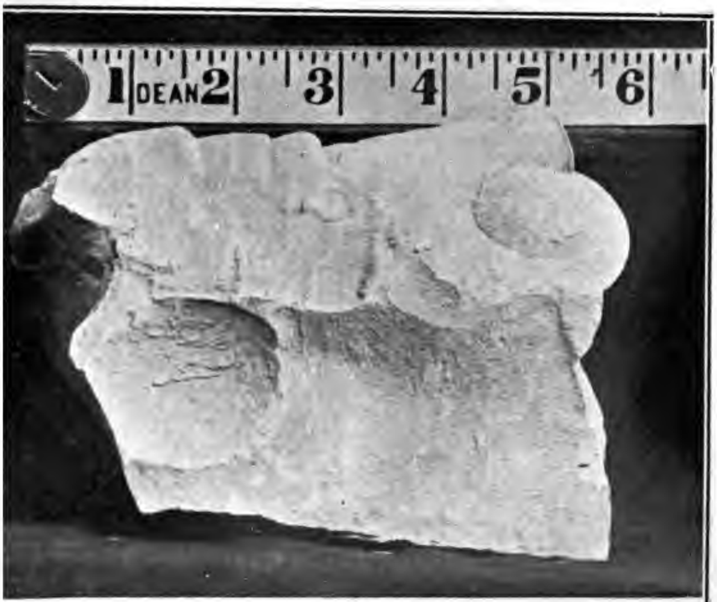
The nodules described in the following paper occur in certain bands in the upper members of the strata disclosed at Duff's quarry, in Forster-street, New Town. The nodule-bearing bands appear to be unfossiliferous, but both above and below them are other bands carrying numerous fossil impressions, including *Alethopteris australis*, *Thinnfeldia obtusifolia*, *Phyllotheca*, &c. The whole series of bands is just below the horizon of the New Town Coal Measures. The beds in which the nodules are found are grey and blue-grey in colour, traversed by thin layers of darker hue, thus giving rise to a banded structure; they may be described as a calcareous sandstone of fine texture, fairly tough, and showing little or no tendency to split along the planes of banding.

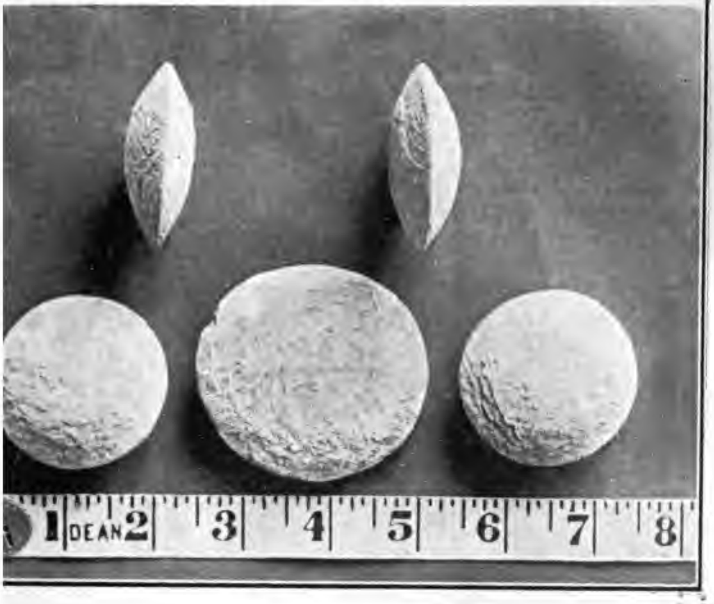
In general the nodules have the shape of double-convex lenses, giving in the most perfect forms a circle in plan and two intersecting circular arcs of different curvatures in elevation. The equatorial planes of the nodules were almost invariably parallel to the bedding planes; in the case of those nodules having bounding surfaces of different curvature the surface of greatest curvature was generally found to be the one lying uppermost. The larger nodules have an equatorial diameter about four inches long, and the lens at its thickest part is about half an inch through; on fracturing, the interior shows a crystalline structure, the surfaces exposed having a steel-blue sub-metallic lustre.

An analysis of the crystalline part of one of these nodules, kindly made for me by Mr. Ward, A.R.S.M., Government Analyst, gave the following result:—

| | | |
|---|---|---|
| Carbonate of Lime ............... | 44·0 | per cent. |
| Silica, &c., insoluble in acid ...... | 50·6 | „ |
| Total Iron, taken as Peroxide... | 4·7 | „ |
| Carbonate of Magnesia and loss. | 0·7 | „ |
| | 100·0 | |

The specific gravity is 2·5.


1 DEAN 2 3 4 5 6


1 DEAN 2 3 4 5 6 7 8

Mr. Ward writes—"The nodule appears to consist of a fine sand cemented by crystalline carbonate of lime."

Slides of the nodules were prepared parallel to and cutting transversely the equatorial plane. In natural light the slide shows a confused micro-granular structure, the component grains being transparent, opaque, and grey; on rotating the slide, a slight change of tint, due to variation of absorption, is noticed. With crossed nicols, large areas of the slide extinguish simultaneously, and it is seen that adjacent crystalline aggregates appear to grow into each other, there being no trace whatever of anything like a definite crystal boundary, or of the twinning characteristic of tabular calcite crystals. Minute angular grains of quartz and opaque matter are irregularly dispersed through the calcite aggregate.

The nodules in which the most perfect geometrical form is developed show little or no crystalline structure on fracture; bands running parallel to the equatorial plane of the nodule are seen to traverse the broken face, and occasionally the area between two consecutive bands, presents a crystalline appearance very similar to that shown in the larger nodules. The nodules of perfect form are rather less than two inches in diameter, and they pass by stages into smaller ones of roughly spherical shape. These smaller ones show a banded structure, but exhibit when broken no traces of crystallisation.

When the containing rock is broken the nodules are separated from the cavities in which they repose without the slightest difficulty. After the rock has been blasted, the nodules may be found lying in all directions, with scarcely a trace of the bed-rock adhering to them. The cavities and the exterior of the nodules, especially those of larger size, are frequently stained red. The nodules appear to occur most numerously along the bedding planes; in one slab, the largest dimension of which was about fourteen inches, seven cavities were counted.

The bed-rock is in places traversed by narrow irregular fissures containing calcite.

# CONTRIBUTION TO THE PHYSIOGRAPHY OF TASMANIA.

By Col. W. V. Legge, R.A.

[Read 1st December, 1902.]

[Plate.]

## No. 1.—Pine Island, Great Lake.

Pine Island is one of the five or six islets which, at wide intervals, dot the surface of the magnificent sheet of water known as the Great Lake.

Considering the shallowness of its waters and its extremely irregular outline, it is singular that there are so few islands in this lake. Those that do exist are all of small area.

Pine Island is situated in the north-eastern corner of the great bend of the lake, the eastern shore of which skirts the foot of the so-called "Sand-bank Tier," a rugged talus-strewn range, about 4 miles in length. The local name has its origin in the sandy shore which bounds this part, and along which the water is remarkably shallow, running out for about half a mile, with a depth of not more than a couple of feet.

During a recent visit, I was much struck with the singular character of the shore of this island; and the desirability suggested itself of writing a short descriptive account of the spot for the information of our Fellows, and in the hope that a satisfactory explanation of the causes which have led to the formation which I noticed, may be arrived at from a discussion on it.

The distance from the head of the lake, where the boat belonging to the "Improvement Association" of Deloraine is kept, is about four miles, and on the afternoon of my trip, in March last, we sailed down (my son and myself), accompanied by Police Trooper Archer, in about half an hour.

The long, low outline of the island is visible from the starting-place, and as we neared it the basaltic "tors," which rise from its centre, became conspicuous. It is said to have been formerly covered with timber, the King William Pine having been chiefly in evidence, but the only signs of this that now exist are the gaunt and bleached trunks of one or two "Cider" gums and one pine. At the "Cove," on the eastern shore, there are several large

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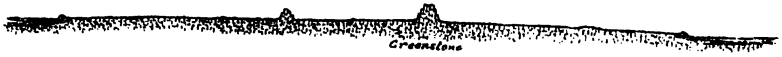
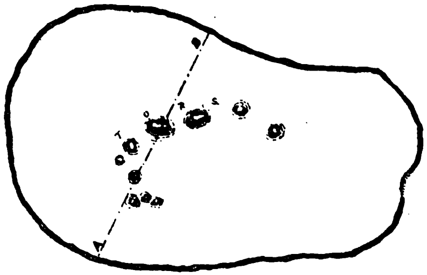
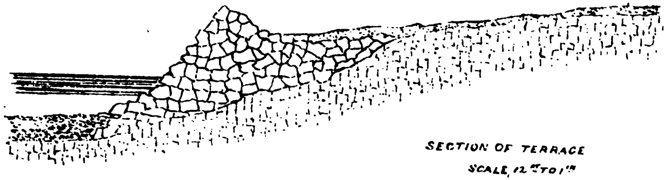
# PINE ISLAND.



IDEAL SECTION ON AB. ; SCALE 30$^{ft}$ TO 1$^{inch}$



PLAN, ENLARGED 12 TIMES
FROM 1$^{in}$ TO MILE MAP.



SECTION OF TERRACE
SCALE, 12$^{ft}$ TO 1$^{in}$

W. L. L.
del.

JOHN VAIL, GOVERNMENT PRINTER, TASMANIA.

fallen trunks of pines lying partly in the water: further evidence of the ravages of fire! The stupid practice of setting fire to the country by shepherds and others, which obtains in the western wilds of this country, is probably answerable for the desolate state of this islet at present. On nearing it, however, scattered green bushes are seen, chiefly near the margin, and these are the only prominent signs of botanical life until one lands, when the surface is found to be fairly covered with the usual coarse vegetation and low bushes found in all open tracts of this upland region.

At about half a mile distant the singular character of the shore becomes apparent, the entire coast-line consisting of a raised terrace, rising about 7 feet from the water, and looking as regular and uniform in structure as if it had been built artificially. In looking for a landing-place we were able to examine the structure of this curious terrace, and found the rocks composing it to vary from somewhere about one ton in weight to stones of nearly one cwt. The face forms a regular slope of 35° or steeper in some places with an almost concave profile, and stands on a formation of small rocks below the surface, projecting outwards about four or five feet as a rule, and skirted by a flat bottom of shingle, the water being not more than three feet deep. The water is shallow all round the island, as indeed it is throughout the better part of the great bay at the north of the lake.

The contour of the west side is circular, the terrace sweeping round in regular curves to the northern and southern sides, which run almost due east to the eastern end, where the terrace is broken by a little cove of shingle, which my son visited, but which I did not, myself, see. The island is about 600 yards long, 250 broad at the widest part, and contains about 30 acres. The shape is roughly given in the accompanying sketch, enlarged from the 1-inch to the mile map of the lake. On landing, we found the group of "tors" we observed in the distance to consist of six or seven mounds of basalt, rising more or less perpendicularly from the surrounding and, in some directions, almost level land, the whole describing a crescent across the centre from west to east. The highest of these eminences was in the centre of the island, and rose to a height of 45 feet above the water, and 30 feet from the ground at its base. The others, at a distance of about 30 to 50 yards from each other, were smaller, the groups at the west end of the crescent being sub-divided into detached rocks. The class of rock, both in the "tors" and the boulders which form the terraced show, is greenstone, of which the entire structure of the island also consists, as here and there the same formation projects through the shallow soil. In view of this fact some clue is obtained as to the cause of the terraced formation of the shore.

The island lies almost in the middle of the strait—about 1½ mile wide—which connects the two great water tracts at the north of the lake, namely, the large "North-West Bay" and equally wide "East Bend"; and from all points of the compass, save two—north-east and south-west—it is exposed to the full force of the waves, with several miles of water behind them. The prevailing gales on the lake are from the north-west, south-south-west and south-west, and an extremely violent sea rises with them. After a hard winter, when the ice is from three to five inches thick, it generally breaks up during these gales, and drives in huge floes, with great violence, on the shore of the island. It seems, therefore, reasonable to suppose that, during the course of the centuries, the effect of wave and ice pressure has been sufficient to cast up what was formerly a foreshore of scattered stones and boulders into rampart, or terrace, now existing. Once this began to assume the elevated character of a roughly-formed terrace, there is no doubt that the ice movement and force of the waves would gradually mould it, little by little, into its present form. The formation of the rampart is equally regular on the south-west and north-west sides, the latter part being somewhat less exposed to heavy weather. Round the whole island, with the exception of the cove or break on the east side, the rock bank is almost of uniform height.

As the botany of these high regions is interesting, it may be proper to remark on the vegetation which we found clothing the islet. The surface is practically level, there being a gentle rise from the shore towards the "tors" in the centre. The soil is, for the most part, covered with a dwarf form of the ordinary cattle or "thatch" grass (*Poa cæspidosa*), thickly interspersed and patched with the Epacris-like bushes *Pultenæa rubumbellata*, *Bechia gunniana*, and *Comesperma retusum*. The second of these was in flower at the time of my visit, and gave colour to the sward. We noticed that the dead tussocks of "thatch" grass (*Poa*) were partly covered with a curious earthy-looking deposit lying on them in thick patches, and on closely examining them found, to our surprise, that the covering was a lichen. The grass is killed in the usual way, by cold and age, as in the lowlands on our cattle-runs, and is apparently then fastened on by this curious lichen. Of flowering grasses, we gathered the tall Alpine Holy grass (*Hierochloë redolens*), the *Craspedia richei*, whose tall stalk and downy, button-shaped flower towered above the dwarf *Poa* grass; we also gathered two other species (*Hypochœris radicata* and *Prasophyllum fuscum*). On the northern shore, near the bank of stones, and here and there elsewhere, isolated bushes of the "Mountain Pittosporum" were found, and these were the tallest shrubs on the island. The Pepper tree (*Drimys aromatica*), with its red stems and berries, was more plentiful than the last, and grew in company with the pretty little bush *Bellendena montana*, which has green leaves, with a red obverse surface. The "Yellow Bush," so well known on the mountain plateaus of Tasmania, with its intensely hard wood, is found on the island, as well as round the shores of the lake; but I have not seen it anywhere so plentiful as on Ben Lomond. Other small shrubs make up the vegetation we observed, and are included in the list at the end of this note, and for the identification of all of which I am indebted to Mr. Rodway.

As regards the zoology of this lonely little tract, one would naturally expect to find it devoid of life; but Mr. Archer assures me he once saw on it the largest specimen of a Porcupine (*Echidna*) he ever came upon; the inference of which discovery is, that this animal must be a permanent inhabitant of Pine Island, or crossed over on the ice previous to a thaw. Whip-snakes are also said to be denizens of it.

The only bird seen was the ubiquitous Pipit, or Ground Lark (*Anthus australis*). The little Gull breeds, at times, plentifully on Garden Island, near the Police Station, and no doubt affects this one, but we had not time to look for evidence in the shape of old nests, many of which we came upon in the former islet.

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The list of grasses and shrubs observed on Pine Island is as follows—

### SHRUBS.

| | |
|---|---|
| *Drimys aromatica* .......... | Pepper Tree. |
| *Pittosporum bicolor* ........... | Pittosporum. |
| *Orites revoluta* ................. | Yellow-bush. |
| *Pultenæa rubumbellata*...... | Native Wallflower. |
| *Bellendena montana* .......... | Mountain Roebel. |
| *Coprosma nitida* ............... | Mountain Currant. |
| *Comesperma retusum* ......... | Purple Broom. |
| *Olearia myrsinoides* . ......... | Rough-leaved Daisy-tree. |
| *Ozothamus Hookeri* .......... | Hooker's Scent-bush. |
| *Bœchia gunniana* ............. | Gunn's Bœckia. |
| *Hakea microcarpa* ............ | Small-fruited Hakea. |

### GRASSES.

| | |
|---|---|
| *Hierochloë redolens* | Tall Holy Grass. |
| *Poa cæspidora* | Thatch Grass, Dwarf. |
| *Craspedia richei* | Soldiers' Buttons. |
| *Hypochæris radicata* | Deep-rooted Dandelion. |
| *Prasophyllum fuscum* | Brown Fly-Orchis. |
| *Prasophyllum patens* | Fly Orchis. |
| *Brachycome sp.* | Mauve Daisy. |
| *Helichrysum bracteatum* | Coarse-flowered Everlasting. |
| *Celnusia longifolia* | Mountain Aster. |
| *Eriochilus autumnalis* | Autumn Orchis. |

# THE TOURMALINE-BEARING ROCKS OF THE HEEMSKIRK DISTRICT.

## By G. A. Waller and E. G. Hogg, M.A.

[Read 1st December, 1902.]

The Heemskirk district was visited some weeks ago by one of the authors in the course of his official duties as Assistant Government Geologist. Most of the field observations then made have already been published in the report on the district recently issued by the Mines Department*, but the necessity of writing these reports as soon as possible after the examination of the district in question is completed precludes the possibility of a minute examination into the microscopical character of the rocks prior to publication. In the case of the Heemskirk district, not only are the field observations of more than ordinary interest, but the additional evidence afforded by micro-examination of the rocks is important. The authors, therefore, think that a short description of the rocks, both as regards their microscopical characters and their field relations, may not be out of place among the proceedings of this Society. It may also be mentioned that, since the publication of the Mines Department report, other portions of the district have been examined, so that some of the field observations here recorded are published for the first time.

Mt. Heemskirk is situated on the West Coast of Tasmania, about 24 miles north of the entrance to Macquarie Harbour. The district may be regarded as extending along the coast from Trial Harbour on the south to Granville Harbour on the north. The major axis of the mountain range runs approximately parallel to, and about 4 miles distant from, the coast. Mt. Agnew is the most southerly and the highest peak of the range, and rises about 2800 feet above sea-level. The mountain range is composed almost entirely of granite, which extends along the coast from a little north of Trial Harbour to beyond Granville. To the south and east of the granite the Silurian slates and sandstones outcrop, and these have suffered metamorphism near their contact with the granite.

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* Report on the tin ore deposits of Mt. Heemskirk, by G. A. Waller, Assistant Government Geologist.

### *The Normal Granite.*

The rock which we have termed the normal granite consists of a medium to coarse-grained biotite granite. It is much more widely distributed than the other types, and appears to be of more uniform composition. The rock shows, on microscopic examination, the following minerals:—Orthoclase, plagioclase felspar, biotite, quartz, tourmaline, iron pyrites, and apatite. The felspars have suffered much decomposition; the clouded appearance of the plagioclase felspar makes the determination of its character very difficult, but the low angle of extinction points strongly to its being oligoclase. It has preceded the orthoclase in the order of crystallisation. The biotite is very pleochroic, and contains on the whole very few inclusions; it appears to have undergone very slight alteration, but it is occasionally somewhat bleached, and a small amount of resorption with separation out of opaque material has taken place. Apatite in small grains is rare, and small masses of iron pyrites, destitute of crystal boundaries, are present. The main interest of the slides centres round the remaining minerals, quartz and tourmaline. The tourmaline occurs as short slender opaque rods, traversing the quartz grains in all directions. The rods, as a rule, are quite straight, but in some few instances they are curved; a radiant structure is very characteristic, the centre of radiation being sometimes a minute speck of opaque matter; in other cases the rods appear to radiate from the line of separation of two quartz grains, and the rods then show a tendency to lie parallel to this line of separation; no case was observed of a rod crossing the line of separation and penetrating both of two adjacent quartz grains.

The distribution of the rods in the quartz is very capricious; they crowd some grains and are comparatively rare in others, while sometimes the same grain may be rich in them in one part while the remainder of the grain is absolutely destitute of them. In one marked case a quartz grain is crowded with needles, and carries a moderate amount of minute opaque specks, while the remainder of the grain, though in optical continuity, is devoid of rods, and almost devoid of opaque specks. The phenomenon would appear to point to the presence here of quartz of two generations, the younger quartz having been deposited from a solution free from tourmaline, and having crystallised round an eroded grain of the older quartz in optical continuity with it. The presence of veins containing iron pyrites in the vicinity seems to support the hypothesis that this normal granite has undergone a small amount of metasomatic change.

### *Tourmaline Granites and Aplites.*

These rocks occur in considerable quantities in many parts of the district, especially in the vicinity of known tin-bearing deposits. Tourmaline granites occur in the form of dykes and masses in the normal granite, and in the latter condition often extend over areas of some hundreds of acres. The tourmaline aplites, or fine-grained tourmaline granites, occur as irregular masses and nodules in the tourmaline granites, and also as dykes, both in the tourmaline granites and in the normal granites. Dykes, nodules, and masses of non-tourmaline-bearing aplite are also found in the normal granites, and dykes of the same rock traverse the tourmaline granite.

The tourmaline granites exhibit a large amount of variation, both in the proportions of the several minerals contained and also in the size of the constituent grains. We have only two somewhat imperfect slides of these rocks at our disposal, so that our description must be principally confined to macroscopical characters. The minerals which may be seen with the naked eye comprise the following:—Felspar, quartz, tourmaline, muscovite, and a dull green mica (probably biotite which has been partly altered to chlorite).

The most striking characteristic of the rock is in connection with the distribution of the tourmaline. This occurs in patches or bundles of radiating needles or prisms, from 1 up to 3 inches in diameter, usually associated with quartz. As the granite becomes finer grained, and approaches to the aplites in structure, the tourmaline loses its radiating character, and, together with quartz and a little felspar, forms more or less well-defined balls or nodules (quartz tourmaline nodules), which occur sometimes distributed at regular intervals through the granites, and sometimes collected together in masses. The groundmass of the rock consists of a medium to fine-grained crystalline granular mixture of quartz, felspar, and two micas. Small miarolitic cavities may be often observed, into which the crystal faces of quartz and felspar protrude. Under the microscope the felspar is seen to consist both of orthoclase and plagioclase, both much decomposed. The quartz differs from that of the normal granite, in that it contains no microscopic rods of tourmaline, the whole of the latter mineral appearing to be concentrated in the quartz tourmaline nodules.

With the exception of a little muscovite, there is no mica present in our sections. It may be said that the mica is generally present in much smaller quantities than in the normal granites, and in some cases it appears to be entirely absent.

From the above description it will be seen that the tourmaline granites differ from the normal granites in the following particulars:—

(1.) The greater amount of variation exhibited by the tourmaline granites, both in the mineralogical composition and in the size of the constituent grains.

(2.) The frequent presence of miarolitic cavities.

(3.) The presence of macroscopic bundles of radiating tourmaline or of quartz tourmaline nodules.

(4.) The absence of microscopic rods of tourmaline in the quartz.

(5.) The presence of small quantities of muscovite, which appears to be absent from the normal type.

(6.) The lesser abundance of biotite.

The tourmaline aplites, as has already been stated, occur in irregular masses in tourmaline granites, and as dykes in both the tourmaline granites and the normal granites. In neither case is there any sign of parting at the contact between the aplite and the granite. In the case of the dykes the walls are well defined, but there is no distinct plane of division, the one rock appearing to "grow into" the other. This phenomenon is ascribed by Rosenbusch* to the fact that the aplite was introduced into the fissures while the granite was still in a highly heated condition. In the case of the masses the contact is even less sharp, and it is sometimes impossible to say within two or three inches where the aplite begins and the granite ends. Occasionally the masses of aplite throw out irregular apophyses into the surrounding granite. The whole appearance of the masses gives the impression that they were formed while both magmas were still liquid, and one may ascribe the irregular shape of some of them to movements in the still molten magma. The aplites are usually much richer in tourmaline than the tourmaline granites. The mineral is, however, confined to the quartz tourmaline nodules, which are often very abundant, and generally are almost perfect spheres. The quartz tourmaline nodules withstand the decomposing action of the atmosphere for a longer time than the surrounding rock, and this causes them to stand out on the weathered surface, giving the rock a very remarkable appearance. From the same cause the subsoil in some localities is largely composed of these nodules.

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* H. Rosenbusch. Elemente der Gesteinslehre, p. 215.

Under the microscope the groundmass of the tourmaline aplites consists essentially of orthoclase, plagioclase, and quartz, with small quantities of both biotite and muscovite. The plagioclase is oligoclase-andesine, or albite. Measurements of extinction angles on sections cut approximately perpendicular to the twining lamellæ give results ranging from 9° to 16°. Some of the quartz appears to have preceded the felspar in order of crystallisation. Some of the grains have defined crystal edges, and they often protrude into, or are included in, the felspar crystals. Like the tourmaline granites, the quartz contains no microscopic rods of tourmaline. One section was prepared, showing the junction between a quartz tourmaline nodule and the surrounding rock. As the centre of the slide is approached, grains and hypidiomorphic crystals of tourmaline make their appearance; they are, for the most part, yellow-brown in colour, and show faint pleochroism. As the centre of the nodule is approached, the felspar—which is almost entirely plagioclase—dwindles, and the rock appears to be entirely constituted of quartz and tourmaline. The quartz occurs sometimes in the form of hypidiomorphic crystals surrounded by tourmaline, which is almost entirely without crystal boundaries; the tourmaline is blue in colour, and moderately pleochroic.

Other slides of nodules show an intensely pleochroic tourmaline of blue colour; the crystals are sometimes of tabular habit, and enclose grains of quartz in such a manner as to give rise to a pœcilitic structure. A small amount of much-altered plagioclase felspar is also present; it has preceded the tourmaline in the order of crystallisation. Rods of tourmaline are absent from the quartz of these nodules. Although not observed in the slides, a small quantity of tin oxide appears to be always present in the quartz tourmaline nodules. A small prospect was always obtained by crushing and vanning the stone, while a bulk assay taken from the nodules occurring at the Federation Mine yielded 0·2 per cent of metallic tin.

The tourmaline aplites may be said to differ from the tourmaline granites in the following particulars:—

(1.) They are finer grained.
(2.) They contain quartz tourmaline nodules in greater abundance, and in larger and more perfectly developed spheres.

(3.) Some of the quartz has preceded the felspar in order of crystallisation. The structure may be described as partly panidiomorphic.

### *Normal Aplites.*

Many of the aplites do not contain quartz tourmaline nodules. They occur in the form of dykes in the normal granite and in the tourmaline granite, and as masses and nodules in the normal granite. One case was observed in which a small dyke of aplite contained a central seam of large crystals of quartz and felspar (pegmatite) with small cavities or druses, into which the crystal faces project. In many other cases miarolitic cavities were observed irregularly distributed through the dykes. Microscopically, the normal aplites closely resemble the groundmass of the tourmaline aplites. They are somewhat even-grained rocks, composed essentially of orthoclase, plagioclase felspar, with a little biotite and accessory tourmaline and apatite. The felspars are much decomposed; the plagioclase felspar, which is relatively less abundant than in the normal granite, appears to be oligoclase-andesine, or albite, and has preceded orthoclase in order of crystallisation. The quartz is more abundant than in the normal granites, and in some cases the grains carry rods of tourmaline quite similar in appearance to those described in connection with the normal granite. Their disposition is very capricious, as they are numerous in some grains and quite absent from others. The biotite shows bleaching and resorption phenomena; apatite occurs as an inclusion in biotite. Some of the quartz has defined crystal edges; it also appears as eyes in the orthoclase. When present in the latter form, tourmaline rods are absent.

### *Quartz Tourmaline Reefs.*

The rocks which have now been described form in part the wall rocks of numerous quartz tourmaline reefs which occur throughout the district. We propose to use the term "reef" in the sense in which it is used locally, and by most mining men in Australia, viz., to denote any non-clastic tabular deposit composed largely of silicious material irrespective of its supposed mode of formation. Until comparatively recent years the filling-matter of fissures was regarded as being divisible into two well-defined classes—one formed by cooling from a molten condition, the other formed by precipitation from aqueous solution; and these classes are still known as dykes and veins respectively. It is, however, now generally conceded that it is impossible to draw any sharp line of division between these two types, and our investigation of the quartz tourmaline rocks of the Heemskirk district affords evidence of this fact. We find that there are both quartz tourmaline dykes and quartz tourmaline veins, and also types which occupy an intermediate position. As it is often difficult to decide at once to which class any given deposit belongs, it is evident that a general term is desirable, and the term "reef" appears to us to be quite suitable.

### *Quartz Tourmaline Veins.*

It is a well-recognised fact that fissure veins are often not merely "fissures filled with mineral matter;" the material forming the vein may have been either deposited in an open cavity formed by the fissure, or it may have been deposited as a replacement of the wall-rock, or of some of the constituents of the latter. In the quartz tourmaline reefs of the Heemskirk district the greater part of the material has been deposited as a replacement of the wall rock, and only a very small portion as the actual filling of the fissure. These two portions of the vein we propose to distinguish by the terms "vein rock" and "vein stone," the former denoting that portion of the vein which has been formed as a replacement of the wall rock, and the latter that portion which has been deposited along the plane of the fissure, and generally in an open cavity.

The quartz tourmaline veins consist of tabular deposits composed essentially of quartz and tourmaline, traversing both the granite and the surrounding Silurian strata. There is a central seam or fissure filled usually with tourmaline, or quartz and tourmaline (the vein stone), and on either side of this is a granular rock composed of quartz, quartz and tourmaline, or quartz and white mica (muscovite or lithia mica) and tourmaline (the vein rock). Both the vein stone and the vein rock may carry tin oxide. The former is sometimes very rich in tin, the ore being often beautifully crystallised; in the latter the tin oxide occurs in crystalline grains, and is often finely disseminated. Pyrites appears to be an invariable constituent wherever the veins have been explored below water-level. It occurs in bunches in the vein stone, and also disseminated through the vein rock. In some cases the vein rock consists almost entirely of granular quartz and pyrite, the latter having the appearance of replacing the felspar of the granite. Besides those already mentioned, most of the other minerals which are of common occurrence in tin veins are present in small quantities, viz., bismuthinite, molybdenite (rare), arsenopyrite, chalcopyrite, galena, and zinc-blende (both of these rare, and in very small quantities), fluorite (in small quantities), and smoky quartz.

The vein rock differs very greatly in the amount of tourmaline present. Often it is composed almost wholly of quartz, but at other times the only quartz present appears to be that which formed the original quartz of the granite, the whole of the felspar being replaced by tourmaline. In other cases the felspar has been replaced by white mica, with or without the addition of quartz and tourmaline. The vein rock then forms a typical greissen. The tourmaline is of two varieties, the black or iron tourmaline and the green or alkali tourmaline. Although tin ore is associated with both varieties, the green tourmaline appears to be much the more favourable indication for tin.

The veins vary in width from a few inches up to 20 or 30 feet; in the latter case there are usually a number of parallel fissures filled with tourmaline running through the vein rock, and the mineralisation has evidently spread outwards from these fissures until the adjacent zones of replacement met in the centre. Often bands or lenticular bodies of unaltered granite exist within the reefs between two such zones. The veins generally run in parallel groups, but often there are several main directions of strike in the same locality. When the veins cross one another there is usually no faulting, pointing to the fact that the fissures were produced by contraction of the granite on cooling. The proof of the metasomatic nature of the vein rock is very conclusive, and may be deduced both from the field evidence and from the examination of thin sections under the microscope. When the veins occur in granite, the vein rock is granular, and the size of the grains is the same as that of the adjacent granite or aplite; there is no parting between the granite and the vein rock, the one seeming to pass over into the other. When the veins traverse sedimentary rocks, the vein rock, or metamorphosed wall rock, retains the original laminated structure. Original differences in porosity or composition have led to deposition of quartz along certain layers, and tourmaline along others, with the result that a black-and-white striped rock is produced, of very striking appearance. Perhaps the most striking field evidence of replacement is to be seen when a vein passes through a granite or aplite which is rich in quartz tourmaline nodules. The nodules are seen in the same abundance and of the same size in the vein rock as in the adjoining wall rock. When the nodules are absent from the wall rock, they are also absent from the vein rock. It is quite evident that the quartz tourmaline nodules, which consist of the same material as was contained in the solutions, were not attacked by them, but remained unaltered while the surrounding felspar of the granite or aplite was replaced.

Microscopic examination of the vein rock entirely confirms these conclusions. Two slides were prepared from a vein-stone poor in tourmaline, replacing granite, which contains quartz tourmaline nodules. The vein stone also contains nodules, but these were not sliced. Both slices are almost entirely made up of quartz, which is present in two forms. It occurs either as large grains, having the usual aspect of the quartz of the tourmaline granites (containing no microscopic rods of tourmaline), and as very small grains confusedly arranged, so as to produce a mosaic structure. A small amount of pleochroic hypidiomorphic tourmaline, enclosing small grains of quartz also occurs either entirely within or nearly surrounded by the mosaic quartz. The tourmaline and mosaic quartz are evidently replacements of the felspar of the granite. There is a tendency of the mosaic quartz to extinguish simultaneously over fairly well-defined areas. The junction of two such areas may be a straight line or an irregular line, suggesting strongly that the orientation of the quartz grains was conditioned by the position of the original felspar grains of the granite, the straight lines representing the contact planes of two adjacent members of a polysynthetically-twinned felspar.

Three sections were cut of quartz tourmaline rock replacing normal granite in which quartz tourmaline nodules were absent. These slides are composed of quartz, tourmaline, and a small amount of opaque matter, disseminated through the former mineral. The two types of quartz which have already been described as occurring in the quartz rock are also present in these slides. The large grains contain a little opaque matter and fluid pores arranged somewhat in linear fashion, and opaque rods of tourmaline showing radiant structure of exactly the same nature as those described as occurring in the quartz of the normal granite. There can be no doubt that these grains represent the original quartz of the granite. The mosaic or secondary quartz is of the same nature as that described in the quartz rock, but is less abundant, and in one of the slides is absent. The tourmaline occurs as idiomorphic crystals of prismatic habit in the secondary quartz, and as confused, ragged masses, sometimes fibrous in structure, and then showing tendency to radiant arrangement. We believe that this tourmaline is a replacement mineral after felspar and biotite, no trace of either of which minerals can be seen in the slides. Contrary to what was observed in the case of the replacing quartz, however, the felspar crystals have not determined any special orientation in the case of the tourmaline. In the slide in which replacing quartz is absent the original quartz grains do not seem to have entirely escaped change. They appear to be corroded around the edges, and to some extent replaced by tourmaline; this appearance is nearly absent from the slides, which contain secondary quartz.

One slide was prepared of greissen, occurring as a replacement of a granite or aplite, containing quartz tourmaline nodules. The rock consists of quartz, tourmaline, and a fibrous mica; the quartz appears for the most part in the form typical of the quartz of tourmaline granite, but there is in addition a small number of minute grains of quartz surrounded by a confused mesh of mica; the mica is in fibrous crystals, sometimes arranged with radial structure; it shows no pleochrism, but there is a considerable amount of absorption of light as the slide is rotated. It polarises in very high colours, and appears to have the optical properties of muscovite. Tourmaline occurs in small quantities as hypidiomorphic pleochroic crystals, but it is not present in the form of rods in the quartz grains. The mica would appear to be for the most part a replacement after felspar, but the occurrence of small nests and meshes of mica in the larger grains of quartz shows that the latter mineral has also suffered replacement. In the slide are a few very minute crystals of a highly refractory substance, which may be zircon; the material of the slide surrounding these specks is frequently coloured brown. One slide was prepared of quartz tourmaline rock, replacing slate which appears originally to have possessed a finely laminated structure. The laminæ have been for the most part replaced by grains of pleochroic tourmaline arranged linearly, and are separated from each other by minute grains of clear quartz.

The vein stone was not examined microscopically. It often consists almost wholly of tourmaline, but is sometimes very rich in tin oxide. The tourmaline often occurs in large bunches of radiating prisms or needles going up to 6 or 8 inches in length. Occasionally, however, a good deal of quartz is present, and this is especially the case where the veins traverse the sedimentary rocks. The tourmaline appears to gradually decrease as the distance from the granite increases, until finally only quartz veins are to be seen. With the disappearance of the tourmaline, disappears also the metamorphism of the wall rock, which is so characteristic of the veins, both in the granite and in its immediate vicinity.

### *Quartz-tourmaline Dykes.*

These interesting dykes were, we believe, first observed by Mr. F. J. Ernst. They are found traversing both the granite and the sedimentary rocks, and are distinguished from the veins by the fact that their structure is not dependent upon the character of the wall rock, since they traverse granites, aplites, and sedimentary rocks without undergoing change. They have no central fissure, and the walls are generally sharp and clear-cut, even more so than the aplite dykes. They are usually of uniform composition throughout, consisting of a somewhat finely granular mixture of quartz and tourmaline, with sometimes a little felspar. When they traverse sedimentary rocks, they often contain included angular fragments of the country-rock. In the slides of this rock which were prepared the only minerals observed were quartz and tourmaline. The former mineral occurs as irregular grains, containing a very small amount of minute opaque specks. Tourmaline is present in well-formed crystals of prismatic habit, as grains, and as clusters of grains and crystals. The larger crystals of prismatic habit have a marked pleochroism, but as the crystals dwindle in size the pleochroism gradually diminishes, and cannot be detected in the smallest crystals. The tourmaline has preceded the quartz in order of crystallisation; radiating prisms of small size frequently penetrate the quartz grains, the centre of radiation being often one of the larger tourmaline crystals. The tourmaline rods previously alluded to are quite absent from the quartz of this rock.

In many cases the wall rock of the dykes has suffered metamorphism in a similar manner to that of the tourmaline veins, but to a lesser extent. In several instances, where the dykes occurred in granite, it was observed that the latter had been converted into quartz-rock or quartz-tourmaline rock, for a short distance (generally not more than a few inches) on either side of the dyke. In other cases, even along the same dyke, the wall rock had remained apparently unaltered. It is conceivable that this metamorphism may have been produced by vapours which traversed the fissure, prior to the introduction of the quartz-tourmaline magma, but it seems more probable that it was caused by emanations from the dyke-rock itself.

Two interesting instances of variation in composition were noted in the dykes traversing the Silurian strata at the Gentle Annie Rise, to the east of Mount Heemskirk. In one case of a dyke 2½ inches in width, a portion of the tourmaline had segregated towards the centre of the dyke and formed a central seam about ¾ inch in width, the remainder of the dyke being composed of the normal quartz-tourmaline mixture. In another case of a somewhat larger dyke, the quartz had segregated, and for a foot or fifteen inches the dyke channel was filled with white quartz almost free from tourmaline. The latter instance seems to point to the fact that the quartz-tourmaline dykes may change to quartz veins as well as the quartz tourmaline veins.

Several observations were made at the Gentle Annie Rise of small quartz and quartz-tourmaline veins being cut through or faulted by quartz-tourmaline dykes. These observations are perhaps not yet sufficiently numerous to establish the relative ages of the two kinds of reefs definitely, but it may be said, that in some cases at least, the dykes are younger than the veins. This conclusion is of great importance, for it proves that the quartz and quartz-tourmaline veins were formed before the close of the period of eruptive action of the granite.

### *Conclusions.*

We may now state briefly the conclusions which we think are justified by the facts which were observed in this district with regard to the origin of these tourmaline rocks and the associated tin-bearing veins.

It appears perfectly evident that the tourmaline is an original constitutent of the granite magma, since in one form or another it is contained in all the rocks which have been examined. There appears, however, to have been a continued tendency for the tourmaline to segregate together and separate itself from the rest of the magma. In the normal granite, it occurs only in microscopic rods in some of the quartz, and must represent an extremely small percentage of the total composition of the rock. But even here there is a tendency for the tourmaline to come together and form minute bundles of interlacing or radiating rods. In the tourmaline granites, the tourmaline is much more abundant, and forms macroscopic bundles of radiating needles, and even granular nodules of quartz and tourmaline. This great increase in the amount of tourmaline present is, we believe, to be accounted for by some process of differentiation or segregation in the original granite magma, while the presence of tourmaline in separate bundles and nodules may be accounted for by a further process of magmatic segregation from the already differentiated tourmaline-bearing magma. The tourmaline-aplite magma may have separated from the tourmaline-granite magma in the same way as the tourmaline-granite magma separated from the normal granite magma. The presence of irregular masses of tourmaline-granite in the normal granite, and of tourmaline-aplite in tourmaline-granite, is we think, convincing evidence that the three types of rock have originated from one and the same magma, and that the differentiation has taken place before, and not after, the consolidation of the magma. A definite order of consolidation of the three rocks may be observed. Dykes of tourmaline-granite occur in the normal granite, but not in the tourmaline-aplite, while dykes of tourmaline-aplite occur both in the tourmaline-granite and in the normal granite. It is evident therefore that the order of consolidation was (1) normal granite, (2) tourmaline-granite, (3) tourmaline-aplite.

The composition of the quartz-tourmaline nodules at once suggests that the quartz-tourmaline reefs are in some way connected with these. In many places the nodules appear to have a tendency to come together and unite to form larger masses of quartz-tourmaline rock. At greater depths, where the cooling of the magma would proceed more slowly, this might well take place, and the quartz-tourmaline magma thus formed might be the origin of the quartz-tourmaline dykes. The presence of the veins, however, suggests that a further separation first takes place within the quartz-tourmaline magma, namely, a separation into a highly aqueous and a less aqueous magma. The former would be virtually a saturated solution, and in this would be concentrated the heavy metals originally contained in the magma, since, from the common occurrence of these metals in mineral veins, we know them to be specially soluble in heated waters. Assuming, now, that such masses of quartz-tourmaline magma were intersected by fissures formed by the contraction of the granite in cooling, the more highly aqueous portion, being the more fluid, would be first erupted, and owing to its highly-heated condition and the presence of such powerful mineralising agents as boron, fluorine (both of these are present in tourmaline), hydrogen sulphide and water would have a very powerful chemical action on the wall of the fissures, producing the complete metamorphism of the wall rock, which has already been described. The more viscous quartz-tourmaline magma might be erupted later and form quartz-tourmaline dykes.

It will be remembered that the quartz-tourmaline veins traverse both the normal granite and the tourmaline granite and aplites, while in several instances the quartz-tourmaline dykes were observed to fault the quartz-tourmaline veins. The relative ages of all of the tourmaline-bearing rocks, described in this paper appear therefore to be as follows,—(1) normal granite, (2) tourmaline-granite, (3) tourmaline-aplite, (4) quartz-tourmaline veins, (5) quartz-tourmaline dykes.

# Royal Society of Tasmania,

(FOUNDED 14th OCTOBER, 1843).

## REPORT FOR 1902.

### ANNUAL MEETING.

'he sixtieth annual meeting of the ṛal Society of Tasmania was held in Society's rooms on Thursday even- , February 26, when there were pre- t: Mr. R. M. Johnston, F.S.S. in chair), the Bishop of Tasmania (the ;ht Reverend Dr. Mercer, M.A.), ssrs. T. Stephens, M.A.F.G.S., A. G. bster, Bernard Shaw, L. Rodway, and L. Piesse, Professor Neil Smith, A., Hon. Dr. Butler, M.L.C., and :ers.

### Annual Report.

'he secretary (Mr. Alexander Mor- ) read the annual report as follows:—

'he Council of the Royal Society of smania have pleasure in presenting this ort for the year 1902, being the sixtieth ıual report of the society.

[eetings.—Eight regular meetings, and special, have been held during the ır. The number of papers read was as against 19 the preceding year. The ıt meeting of the session was opened by new president, His Excellency Sir E. Havelock, G.C.S.I., G.C.M.G., who very cordially welcomed by the large :hering of members on his accession to chair. His Excellency then delivered interesting address to the Fellows, and taken the chair at all the meetings ring the year, besides showing in many ys his practical interest in the working the society.

?apers.—The papers read during the sion have shown no falling off in va- ty, nor in importance. Subjects treat- were:—Ichthyology, Conchology, Ento- logy, Botany, Geology, Mineralogy, restry, Astronomy, Geography, Health d Economics. The papers dealing with alth subjects and the consequent dis- sions, were of special value at the sent time. when the necessity of un- rground drainage is being brought so ominently before the citizens.

[he subjects and authors of the papers d are as follow:—

:chthyology.—1. "Notes on a new fish eudochrinus rodwayi)." 2. "Description a new species of goby (Gobius hinsbyi)." R. M. Johnston, F.S.S.

:onchology.—3. "Note on Tasmanian schology," by Chas. Hedley, F.L.S. 4. "Notes on some of Tenison-Wood's types in the Tasmanian Museum," by W. L. May.

Entomology.—5. "Notes on some remarkable Tasmanian invertebrates," by A. M. Lea.

Botany.—6. "Note on Eucalptus linearis." 7. "The gum-topped stringy barks in Tasmania." 8. "Note on a species of Eucalpt new to Tasmania," by J. H. Maiden, F.L.S. 9. "Some Additions to the Bryological flora of Tasmania," by W. A. Weymouth.

Geology and Palæontology.—10. "Discovery of Graptolites in Tasmania," by T. S. Hall, M.A. 11. "Notes on recorded and other minerals occurring in Tasmania," by W. F. Petterd, F.Z.S. 12. "Notes on some Tasmanian Calcareous nodules," by Professor Hogg, M.A. 13. "On the Quartz Tourmaline rocks of the Heemskirk district," by Professor Hogg and G. A. Waller. 14. "Trachydolerite in Tasmania," by W. H. Twelvetrees, F.G.S.

Forestry.—15. "Suggestion for the establishment of a Tasmanian School of Forestry and Agriculture," by W. Heyn. 16. "On the advantages of Forest conservation," by C. B. Target. 17. "Tasmanian timbers, their qualities, uses, etc.," by A. O. Green.

Astronomy.—18. "Practical Astronomy in Tasmania," by Professor A. McAulay, M.A.

Geographical. — 19. "Contributions to the Physiography of Tasmania," by Col. Legge, R.A.

Health.—20. "The disposal and purification of sewage," by E. H. Wilkinson. 21. "Typhoid in Hobart and Melbourne, and the influence of drainage in its prevalence," by Dr. Jameson.

Economics.—22. "Tasmania as a manufacturing centre," by R. E. Macnaghten, B.A.

New Room. — The new room, used last session, was very much appreciated by members, who now for the first time since the establishment of the fine library, find all the books placed in an easily accessible position, while the facilities for study are also much increased.

Library.—The usual number of scientific exchanges have been received during the year.

Centenary of Tasmania.—During the present year Tasmania will have completed the hundredth year of her existence as a British colony, and it would be quite fitting that the Royal Society, which has always taken an interest in matters historical, should initiate, or co-operate with, a movement to celebrate an event of so much national importance.

Obituary.—It is again the painful duty of the Council to record the loss by death of one of its members. Mr. A. Mault, who for many years had practically helped in the working of the society, and had contributed many valuable papers, passed away in November last.

Changes in the Council.—The vacancy on the Council caused by the death of Mr. Mault has been filled by the appointment of the Right Reverend Dr. Mercer, Lord Bishop of Tasmania.

Fellows.—Ten Fellows have been elected during the year.

Finace.—Balance from 1901, £103 9s. 4d. The income of the society from subscriptions has been £170 10s., and the expenditure £227 18s 3d, leaving a balance of £46 1s 1d.

The chairman moved the adoption of the report.

Mr. T. Stephens seconded the motion, and said the report bore testimony to the energy and zeal of their indefatigable secretary, and the way in which he had worked during the year. (Hear, hear.) He suggested that the former practice of printing an alphabetical list of the Fellows in the annual report be revived.

The motion was agreed to.

Mr. Stephens then moved,—"That the Council be requested to have the report printed and published, with an alphabetical list of Fellows, balance-sheet, and minutes of this meeting, according to the former practice, as appeared in the report for 1891."

Mr. Bernard Shaw seconded the motion.

Mr. Webster moved, as an amendment, that instead of printing and publishing the list of Fellows, the list be posted up in the Society's room.

After discussion, Mr. Stephens's motion was agreed to, with the addition of the words, "and that a list be prepared and exhibited in this room."

### Election of Members.

Four retiring members of the Council — the Bishop of Tasmania, Mr. Russell Young, Mr. Bernard Shaw. and Professor Neil-Smith, were unan
re-elected, on the motion of th
Dr. Butler, seconded by Mr. Rod

### The Press

Mr. Stephens moved a vote of
to the Press for the valuable
rendered to the Society during t

The secretary seconded the
and said that it was 19 years th
ing since he arrived in Tasmani
during that time the Press ha
very liberal to the Royal Society.
times as much as four columns a
in "The Mercury" of the procee
the Society. The papers also r
great aid in forwarding the inte
the Museum. The accurate ma
which the proceedings of the Soc
ten of a technical nature, were r
in "The Mercury" was a credit
Press of Tasmania.

The chairman warmly support
motion, which was passed with a

### Diamond Anniversary.

The secretary drew attention
being the 60th anniversary of t
ciety, and the first meeting in th
room.

The chairman mentioned that i
ber next it was proposed to c
this, and at the same time the
ary of the State. He believed Hi
lency the Governor was interesti
self in the matter of commemora
same.

### Freycinet Peninsula.

Mr. Stephens drew attention t
ter in "The Mercury," from Dr. 
of Melbourne, advocating a rese
on Freycinet Peninsula as a N
Park. He would like to see the
take the matter up by commend
Barrett's proposal to the favoura
sideration of the Government.

The chairman said a paper w
before the Society on the subje
years ago.

Mr. Bernard Shaw said it was
years ago that a paper was re
which he supplied some materi
considerable quantity of alluvial
been found there, and it might
an important mining centre.
tailed disturbing elements in con
with the proposal.

After discussion, Mr. Stephens
would revive the question befo
Council on some future occasion.

The meeting then terminated.

## Statement of the Funds of the Royal Society for the Year 1902.

| 1902. RECEIPTS. | £ | s. | d. | 1902. EXPENDITURE. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Balance... | 103 | 9 | 4 | By Salaries | 56 | 0 | 0 |
| Subscriptions | 170 | 10 | 0 | " Sundries | 171 | 18 | 3 |
| | | | | Balance | 46 | 1 | 1 |
| | £273 | 19 | 4 | | £273 | 19 | 4 |

I have this day examined the books and vouchers of The Royal Society of Tasmania, and found same to be correct and in accordance with Balance-sheet herewith.

H. W. W. ECHLIN,
Auditor.

Hobart, 17th Feb., 1903.

## Statement of the Funds of the Morton Allport Memorial Fund for the Year 1902.

| 1902. | £ | s. | d. | EXPENDITURE. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Balance... | 15 | 12 | 9 | Expenditure during 1902, *Nil* | 0 | 0 | 0 |
| Interest | 10 | 4 | 0 | Balance per Savings Bank, January 26th, 1903 | 25 | 16 | 9 |
| | £25 | 16 | 9 | | £25 | 16 | 9 |

# LIST OF FELLOWS OF THE ROYAL SOCIETY OF TASMANIA.

*** Fellows who have contributed Papers which have been published in the Society's Transactio**

*Abbott, Francis
Allwork, Dr. F.
Anderson, Dr. G. M.
Archer, W. H. D.
*Atkins, C. J.
Barclay, C. J.
Bennison, Thos.
Bidencope, J.
Booth, Chas.
Boyd, Dr. P.
*Brown, Hon. N. J.
Burgess, Hon. W. H.
*Burbury, F. E.
Butler, Hon. Dr.
Butler, Francis
Clark, His Honor Judge
Clarke, Rev. Geo.
*Clarke, Dr. A. H.
*Counsel, E. A.
Crosby, Hon. Wm.
*Crouch, Dr. E. J.
Cox, Col. C. B.
Davies, Hon. C. E.
Davies, J.G., C.M.G.
Dobson, Senator H.
Drake, Dr. F. H.
Evans, T. M.
Kay-Ewan, E. D. Mc
Finlay, W. A.
Foster, H. D. (Life Member)
Giblin, Dr. W. W.
*Green, A. O.
Griffith, H.
Grove, F., C.E.
*Harrison, M.
*Hogg, Prof. E. J.
Holden, Dr. L. A.
Horne, Wm.
Hudson, Chas.
Ireland, Dr. E. W. J.
Jameson, Mrs. (Life Member)
*Johnston, R. M., F.L.S.
*Kingsmill, H. C., M.A.
Knight, H. W.
*Legge, Col. W. V., (Rd.)
Lewis, Sir Elliott
Lewis, Major R. C., D.S.O.
Lines, Dr. D. H. E.
Lodge, F., B.A.
Macfarlane, Senator Jas.
Macfarlane, John
Macgowan, Dr. E. T.
MacLeod, P. J., B.A.
*Mault, A.
*McAulay, Prof. Alex.
*May, W. L.
Maxwell, Eustace
McClymont, J. R., M.A. (Life Member)
Middleton, A. E., C.E.
Mitchell, J. J. (Life Member)
*Moore, G. E.
Mulcahy, Hon. E.
Murphy, His Grace Archbishop
Nicholas, G. C.
Nicholls, Hon. H., M.E.C.
*Patterson, R.C.
Parker, A. C.
*Petterd, W. F., C.M.Z.S.L.
Petersen, C. B.
Philp, J. E.
Piesse, E. L., B.A.
Propsting, Hon. W. B.
Read, Dr. G. F.
Read, R. C.
Reid, F. W.
Roberts, H. L.
*Rodway, L.
Rogers, R. J.
Rule, C. H.
Salier, F.
Scott, Rev. Jas., D.D.
Scott, Dr. R. G.
Shaw, Bernard
Shoobridge, Rev. Canon
*Simson, Aug.
Smith-Norton, J. W.
*Sprott, Dr. Gregory (Life Member)
*Stephens, Thos.
Sticht, Robt. (Life Member)
*Swan, E. D.
Swan, C. C.
*Target, C. B.
Thorpe, A.
Twelvetrees, W. H., F.G.S.
Walch, C. E.
*Wallace, W. H.
*Waller, G. A.
Watchorn, A.
Watson, H.
*Ward, W. F.
Webster, A. G.
Whishaw, Dr. R. K.
*White, O. E.
*Wilkinson, E. H.
Williams, Prof. W. H.
Winter, A.
Wise, H. J.
Woflhagen, Dr. J. E.
*Woollnough, Rev. J. B., M.A.
Wright, Howard
*Young, Russell

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# PAPERS & PROCEEDINGS

OF THE

# ROYAL SOCIETY

OF

# TASMANIA,

FOR THE YEARS

## 1903-1905.

(ISSUED MARCH, 1906.)

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The responsibility of the Statements and Opinions given in the following Papers and Discussions rests with the individual Authors; the Society as a body merely places them on record.

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# Royal Society of Tasmania,

Hobart, Tasmania.

Those persons who are inclined to benefit the Society by legacies are recommended to adopt the following

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I give and bequeath unto the "Royal Society of Tasmania" the sum of £ such legacy to be paid out of such part of my personal estate, not specifically bequeathed as the law permits to be appropriated by will to such a purpose.

# *Royal Society of Tasmania.*

## ABSTRACT OF PROCEEDINGS, APRIL, 1903.

### PENING MEETING OF THE 1903 SESSION.

he members of the Royal Society of
mania held their opening meeting of
1903 session on Tuesday evening, the
ı April, the President, His Excellency
A. E. Havelock, G.C.S.I., G.C.M.G.,
siding. His Excellency was accom-
ied by Lady Havelock, C.I., Captain
ppard, R.A., Private Secretary, and
ly Havelock's brother, Mr. W. E. Nor-
. There was a large attendance of
mbers and friends present, including
s Lordship the Bishop of Tasmania and
s. Mercer, Mr. J. H. Barber, of Ceylon,
o was a judicial officer there during
time that Sir Arthur Havelock was
vernor; Sir Jno. Dodds, and the Rt.
v. Dr. Delany, Bishop of Laranda. On
rival, Lady Havelock was presented
th a handsome bouquet (with the Have-
k colours), as was also Mrs. Mercer.

### Correspondence.

The Secretary (Mr. Alex. Morton) read
e following letters:—
'Cullenswood House, Cullenswood, 7th
ril, 1903. Dear Sir,—I much regret,
at owing to my having to be present at
e opening of the St. Mary's produce
ow on Wednesday, the 15th inst., in my
pacity as president, I shall not be able
come to the opening meeting of the So-
ety. I desire again to tender my
anks, as a member of Council, to His
cellency for the keen interest he has
ken in the work of our Society, and to
press the hope that His Excellency may
his way to continue that interest dur-
g the coming session. I would like to
ll attention to the very valuable acqui-
ion to the Museum of the handsome
d instructive series of coloured plates
Japanese fishes. They add consider-
ly to the educational value of the insti-
tion, and will be especially interesting
visitors from the neighbouring States.
may mention that Mr. H. C. Kingsmill,
eteorological Observer, and myself
de a trip in March to the Great Lake.
e result of our work will, I trust, add
siderably to our knowledge of the
ysiography of Tasmania. We took ex-
ustive soundings of the Lake, and mea-
ed the inflow of the streams at the
rth end, we were there during two
vy falls of rain, and were enabled to
erve the very large supply of water
ing in from the ranges round Dry's
ff. This supply is constantly renew-
owing to the wet climate at the north
, the rainfall being three and a half times what it is at the south end."—I am, etc. (Signed) W. V. LEGGE. Member of the Council)."

Letters from Sir Adye Douglas, Mr. R. M. Johnston, the Hon. N. J. Brown, Mr. Russell Young, and the Hon. Dr. Butler, regretting that, owing to their absence from Hobart, they were unable to attend, were read.

### THE ANNUAL ADDRESS.

His Excellency then delivered the following opening address:—

Vice-presidents and Fellows of the Royal Society,—For the second time there devolves upon me the honourable and agreeable duty of presiding at the first meeting of the annual session of the Royal Society of Tasmania. On this occasion, as on that of the opening of the session of last year, the Council have decided that our formal proceedings shall be short, and that our meeting this evening shall take the pleasant form of a social reception, rather than the more serious character of a scientific conference. The agreeable recollection of last year's first meeting will, I am confident, reconcile you to this programme.

### Review of Last Session

I think it fitting that I should pass in review, and I will do this as briefly as possible, the work of the session of 1902. The Charter of the Royal Society lays down as its leading objects the investigation of the physical character of Tasmania, and the illustration of its natural history and productions. The records of the society show that a wide interpretation has been given to this enactment. One of my predecessors, when opening the session of 1887, in commenting on the extent of the range of the subjects dealt with by the society, remarked that its operations and investigations had covered so vast an area as to include such diverse subjects as the occultation of Jupiter and the Drainage of Hobart. The same distinguished president, when addressing the society, for the last time, in 1892, spoke as follows:—"The attention which is now being given on all sides to social and economic subjects has left its mark upon the work of our society for 1892; and the papers upon such subjects, and the discussions arising upon them, form a marked feature in this year's proceedings. While on the one hand, I myself should be very sorry to see the Royal Society ofTasmania so far depart from the original intention of its founders as to develop into more or less of a debating society on social and economic subjects, on the other, to exclude

# ABSTRACT OF PROCEEDINGS, MAY, 1903.

The monthly evening meeting of the Royal Society of Tasmania was held in the evening of the 12th May, 1903. The president, His Excellency Sir Arthur E. Havelock, G.C.S.I., presided.

### Apologies.

The following telegram from Senator Macfarlane was read:—"Launceston. Kindly express to your meeting to-night my regret engagement here prevents my presence to hear and discuss such important paper as Tasmania's manufacturing developments." Sir Eliott Lewis and Mr. R. C. Patterson also sent apologies.

### Election of New Fellows.

The following new members were elected Fellows of the Society: The Right Rev. Dr. Delany (Bishop of Laranda), Drs. A. J. J. Triado and E. J. Roberts, and Mr. A. G. K. Money.

### Royal Medals.

The President read a letter from Lord Francis Knollys, Private Secretary to His Majesty the King, announcing that His Majesty had been pleased to present to the Royal Society a medal which was struck in commemoration of the Coronation. The medal was inspected by the members of the society. Also a medal commemorating the vist of Mr. Chamberlain to South Africa, presented by Mr. A. Butterfield, jeweller.

### Exhibits.

On the table was an interesting specimen of slickenside ore, from South Lyell mine; also some of the fish referred to in the secretary's notes.

### Papers.

A geological excursion to Port Cygnet in connection with the Australasian Association for the Advancement of Science, 1902.

By W. H. Twelvetrees, F.G.S.

The author describes the visit of members of section C (geology) of the A.A.A.S. to Port Cygnet in January, 1902. The special object of the excursion was to examine the elæolite syenite, tinguaite, and allied rocks of the alkali division, which have aroused interest in geological circles in Australia. The rocks occur as a zone traversing the country near Lovett in a N.E.—S.W. direction, and emerging on the shores of d'Entrecasteaux Channel at Oyster Cove. They are broken through by the mesozoic diabase, which is prolonged southwards from Mount Wellington, and in their turn they intrude into sedimentary strata of Permo-carboniferou
Their probable age is the close
Permo-Carboniferous. At the re
ground, Port Cygnet, a projecting
land was found to consist of elæolit
alkali syenite, with dark differen
margins of jacupirangite, essexite,
nephelinite. These marginal variet
not separated from the main m
syenite, but are produced by imperce
variations, the result of differentiati
the magma. As affording illustratic
differentiation, the Port Cygnet a
destined to become classic. A type
tion of the rocks was forwarded t
great German master in petrology,
fessor H. Rosenbusch, who has furn
with his usual kindness, valuable id
cations of the rarer varieties. The
phyries of Mount Livingstone were
nised by him as elæolite syenite porp
and the basic differentiation produ
the elæolitic magma of the regatta g
received from him their proper diag
though he confesses that some o
varieties do not exactly correspond
any of the alkali rocks known to him.
presence of hauyne or nosean in the
Livingstone elæolite syenite porphy
confirmed. In the mica sölvsbergite
of the regatta ground Professor
busch detected a mineral of the p
lore group, and he suggests that the
of creeks flowing over the jacupira
syenite at Regatta Point be examine
the interesting mineral, badde
(dioxide of zirconium). These int
rocks carry pyrites, and along the li
their contact with the sedimentary
some silification has taken place.
of the contact stone assays 5oz. to 6
silver, and from ½dwt. to 2dwt. or
gold per ton. The district has y
about 3,000oz. alluvial gold, most of
was won on the small flats near Ly
ton. The variations which distin
the Port Cygnet rocks from alkali
elsewhere may be appealed to in ill
tion of the theory of petrological
vinces. Possibly new names may
quired for some of them. The stu
the group is not complete, but at p
the author arranges it as follows:—

Family 1.—Alkali Granite: not
sented.

Family 2.—Alkali Syenite: Quartz
Syenite. Alkali Syenite.

Family 3.—Elæolite Syenite: El
Syenite, Elæolite syenite porphyry.
sölvsbergite. Sölvsbergite porphyry.
guaite porphyry. Jacupirangite.

Family 4.—Essexite: Essexite.

Family 5.—Theralite: Mica-nephel

Family 6.—Ijolite: not represente

To complete the enumeration of alkali
ıcks in Tasmania, occurrences in other
ırts of the island are given, viz.:—

Family 4.—Essexite: (a) Trachydolerite
Table Cape and Circular Head; (b)
elilite basalt on Shannon Tier, Sandy
ıy, and near Rokeby; (c) Limburgite
ar Burnie.

Family 5.—Theralite: Nephelinite on
annon Tier.

The author favours two primary divi-
ns of eruptive rocks, viz., one compris-
; granites, syenites, diorite, gabbro, and
ultra basics. All these at times blend
h each other, and give birth to pas-
e rocks between them. The other divi-
n consists of the alkali rocks. The lat-
, though not so abundant as the for-
r, show a great aptitude for differen-
ion in the alkaline magma, hence nu-
rous variations from type forms and
reasing additions to the nomenclature.
Tasmanian occurrences are conse-
ntly of distinct interest.

Ir. R. M. Johnston explained the fea-
es and great importance of the paper
the mining and geological world.

## SMANIA FROM A MANUFACTURING AND IMMIGRATION POINT OF VIEW, AND HER NATURAL ADVANTAGES.

(A. O. Green.)

Vhen we read of twenty thousand im-
grants arriving in the north-west of
ıada in a single month, it seems hard
acount for the very slow increase of
population in Tasmania, especially
en her many advantages are con-
ered.

t is the object of this paper to enumer-
these advantages. In doing so, it will
necessary to state some things that are
-evident to us; but it is good to re-
nise the advantages of the land we live
and, if the knowledge can be com-
nicated to others, it may tend to the
cess of the object in view, namely, to
rease our present population of about
hundred and eighty thousand people
y considerably.

Dur small population has been one rea-
of our fewness, as in the past, owing
artificial divisions among the States of
at is now the Commonwealth of Aus-
Australia, number nearly four millions, and a great impulse has been given to the trade of the island, which, if taken advantage of, may lead to Tasmania becoming a manufacturing and distributing centre for Australia.

### POSITION.

Tasmania is very favourably situated geographically, being only a short distance to the south of the mainland of Australia, and, roughly, in a central position with regard to the coast line of that country. It is also in the direct line between New Zealand and South Africa. Its shore line is considerably broken by deep inlets of the sea, and the greater part of the country is near water carriage, thus bringing the markets of the world within easy reach, at a small cost for carriage.

### CLIMATE.

The climate is equable and temperate, and the rainfall is regular, so that extremes of drought and heavy floods are unknown; in favoured situations, oranges and lemons can be ripened in the open air; geranium hedges are common, and snow only lies in the elevated districts. The days are usually bright and pleasant, and the nights, even in the hottest summer, are cool and bracing.

The central parts of the island are at an elevation of 1,000 to 3,000 feet, and it is easy to get a considerable change of climate by travelling a short distance. Upon these upland districts are large lakes, supplying quickly falling streams, from which ample power can be obtained.

Soil.—The soil is of good average fertility, and in some districts exceptionally fertile. The average crop for the island is over 20 bushels of wheat to the acre, and 5 tons of potatoes. In some districts the average is considerably higher, and potato crops of 12 tons to the acre are not uncommon. In well-managed orchards three to five hundred bushels of apples are picked.

### NATURAL ADVANTAGES.

The present year is the one hundredth since Tasmania was first colonised, and on every side there are indications that in the near future Tasmania will become one of the most prosperous States of the Empire. The towns, though small, have most of the conveniences of large European cities, in the way of water supply, country has been opened. The effect of climate and soil on the growth of crops and the rearing of cattle and sheep is well known. The method of dealing with fungi and insects inimical to cultivated crops has been put upon the solid basis of experience, and there is every prospect of remunerative employment for a very much larger population than Tasmania has at present. While Victoria was passing through the first excitement of the gold diggings, Tasmania supplied a very large portion of the food of that colony, and, owing to the facilities of water carriage, can still place produce in Melbourne and in other capital cities of Australia at a lower rate for freight than mainland districts that are very much nearer to those capitals.

Freetrade.—In the past, the transfer of produce was very much hindered by intercolonial duties, but these are now all done away with.

The advantages of the climate and soil of Tasmania have been brought into great prominence by the dry seasons that have obtained upon the mainland, culminating in the severe drought of last year, and many mainland farmers are coming to Tasmania to farm, where the land laws are liberal, the horrors of drought, extremes of heat, and devastating floods are unknown, and in many places grass is green all the year round. Also, owing to its position, its available water power, and that factory legislation in Tasmania places less restriction upon trade than other States of the Commonwealth do, it is certain that factories will be set up in Tasmania in preference to other parts of the Australian mainland, and there is already a noticeable increase of activity in agriculture, trade, and manufacture.

## SMALL INDUSTRIES.

It is undoubted that in the first place the prosperity of new countries must depend largely upon agriculture, especially upon what are termed small industries—industries where profits are derived from the economical working of the soil, and which enable large families to live comfortably on small acreages. The growth of fruit and potatoes meets this requirement, and by them it is quite possible to have a population of as much as one to the acre. In this, these industries differ widely from what until recent years has been the staple industry of the colony, the rearing of sheep and export of wool. In rearing sheep, people strive for loneliness, so that the sheep may not be disturbed, and in many cases efforts are made to keep population away; but with small *industries supporting* families of ten, upon ten to fifty acres of groun
tilled, it is quite possible to su
population of one to the acre, a
diary mechanical industries, such
mills, wheelwrights, carpenters,
smiths, tailors, shoemakers, tin
casemakers, all follow just as wa
up a hollow.

During the past twenty years t
export industry has been developi
in 1902 fruit and jam were exporte
value of nearly £450,000, being
crease of about 30 per cent. on t
ceding year. This industry has bee
ing at an increasing rate for som
past, and has been the cause of
spread prosperity, great increase
value of land, and has brought
trades to Tasmania previously u
in the island.

Potato growing has become
large industry. During las
potatoes were exported to the va
£325,000. Both these industrie
only small capital and small h
and the benefit from them is ver
spread, tending more to the gener
perity and activity than indus
which only a few are benefited.
also are bringing other industries
train, in the canning, drying, pre
and packing for distant markets.

Canning and Drying.—These tr
canning, preserving, and drying
yet in their infancy, but when t
fully developed fluctuations and
the markets will be largely don
with. There is very little done in
potatoes, for which there are splen
portunities, and the making of sta
not been touched.

Starch.—On some occasions du
cent years large quantities of
that have missed the markets ha
spoilt, thus causing great loss.

Spirits.—The making of starch
the making of spirits, which w
another item of profit.

Cider.—Cider also could be ma
largely, and besides being a source
fit in itself would help to stea
fruit trade. Cider is made in
way at present, with very fair
but not as a large business. In
the fruitgrowing districts in E
the cider press comes round to th
ers just as the chaff-cutter, threshi
chine, and straw baler, do here.

Oats and Barley.—The norther
of the island are especially suited
cultivation of barley and oats, b
the home market and for export.
about £140,000 worth of oats w
ported.

Hops.—Hops also do well, and a
tivated successfully to a limited

ports for 1902 are valued at about
This business could be con-
ly extended.

—Owing to natural conditions, bet-
can be brewed in Tasmania than
r parts of the Commonwealth of
ia.

ing.—Small beginnings have been
ully made in the weaving of
s, flannel, and tweed, and in the
of biscuits. Under the new Cus-
gulations all these industries are
o grow.

Communication.—One of the re-
the growth of the above indus-
s been an increase in the tonnage
ners calling at the ports of Tas-
not only from the other colonies,
m Europe. The tonnage for 1903
esent year) entering the port of
alone is estimated to reach about
dred thousand tons net, or a mil-
s gross. This port is a fine open
f water, completely landlocked.
arves, situated 12 miles from the
a, can berth the largest ocean
eamers, and during the past sea-
le vessels have been loaded with
venty thousand tons of cargo, and
ft the wharf without trouble,
thirty-one feet of water. At
the steamers from London via
e to New Zealand make Hobart a
call; also a new line from New
to the Cape, and besides this, the
O., Orient, Pacific, White Star,
Blue Funnel, and intercolonial
s of several companies call at
ports in the island. The new
steamers about to be started from
land to the Cape, making Hobart
of call, besides increasing the fa-
of transport, will be likely to
e cost of living.

are prospects of several other
that are at present minor indus-
rowing, in the near future, to a
lume.

, Cheese, and Poultry.—The cli-
d soil of the island are excep-
good for the production of but-
ese, bacon, eggs, and poultry.
ool storage works are being erect-
at Hobart and at Launceston,
their help there will be every op-
ty for developing a large export
these commodities.

-Not only do the large lakes and
bound with salmon and trout, as
native fish of several kinds, but
round the coast, and the estuaries,
ndantly supplied with fish. At
the fishing industry is without
ation, and is carried on upon a
cale. Freezing works and cool
are only just being established.
Canning, drying, and salting are also in their infancy. Owing to the lack of these conveniences in the past little could be done with large catches, but fish of many varieties are abundant upon the coast at different times of the year; and with the advantage of cool storage, and, with the development of canning and salting, and the present facilities of communication, there is every probability that the fish trade will become a large industry. Now the boats are small, and the men get a precarious livelihood; but when freezing, salting, and canning are established the effect will be to cause the industry to settle down upon reliable lines, and there will be no difficulty in preserving catches of any size, and in distributing them amongst the markets of the world.

## TIMBER, TAN BARK, PERFUMES, ETC.

The acacia (known as wattle bark), a tree which is common all over the island, produces a bark rich in tannin, and would well repay systematic cultivation. The bark is collected in a somewhat wasteful and primitive way from the natural growth, but the cultivation of wattle in plantations is unknown, although it is probable that if systematically carried out it would be a very profitable industry; wattle bark to the value of £40,000 was exported during 1902. A large extent of the country, especially the eastern half of the island, where land is to be had at a reasonable price, will grow wattle bark to advantage. Flowers of many kinds for perfume, and honey, would do well; fruit also could be grown to advantage, and would probably ripen earlier than in the districts already planted; would realise good prices, and would enable the present output to be very largely exceeded without increasing the difficulty of disposing of the crop. The East Coast, though settled in the early days, has been lying dormant for many years; but it can be recommended to persons wishing to acquire land which would not involve the very heavy labour of clearing. The climate of the East Coast is remarkably equable and salubrious, even for Tasmania; the rainfall is regular, and the soil is of good average fertility. The East Coast appears an ideal place for the production of fruit, honey, and perfumes. Neither honey nor perfumes are made as an industry in Tasmania, although in other countries less favourably situated, incomes amounting individually to thousands of pounds are made from these industries.

At the present time large districts in Tasmania are covered with forests, growing trees of immense size, and there are great possibilities in the systematic development, not only of the timber trade, but also of the allied industries. The seeds of Tasmanian trees have been planted all over the world, and it would be safe to say that there is a larger trade in utilising the timber grown from Tasmanian seed in foreign countries than in utilising the timber of the island itself.

There are also great possibilities in the distillation of the essential oils contained by a large proportion of the leaves and flowers of the Tasmanian flora. Of these, the oil of the Eucalyptus globulus is exported, and is known widely for medicinal purposes, and for the making of varnish. Very little is done in the small industries, such as brushware, cooperage, hurdles, baskets, tool handles, walking sticks. The drying and seasoning of timber for the better class of work by artificial means, the making of potash, pyroligneous acid, and wood pulps are all untouched. And neither the conservation of the forest nor the planting of native or foreign trees for profit is practised. There are very large possibilities in turning to account the great forest wealth that exists in Tasmania, and when it is thought that of the £26,000,000 that is paid annually in England for imported timber none is paid to Tasmania, it is evident that full advantage has not been taken of this great natural source of wealth.

In the foregoing especial stress has been laid on the number of businesses that can be successfully carried on in Tasmania. In each and all of these businesses large capital can be profitably invested; but they have the further advantage that it is equally possible for men of small means to make a comfortable income, and special attention has been called to them, as they may form the sources of wealth for a large resident population.

## PASTORAL AND MINERAL.

Another industry of Tasmania is the breeding of stud sheep and the production of wool. Tasmania, from its cool climate, is capable of producing the very finest sheep, and it is a necessity that the warmer colonies should constantly replenish their stock from a cool climate like Tasmania, in order that the staple of the wool may be preserved. Tasmanian stud sheep are celebrated all over Australia, and bring in large incomes to those who carefully observe the conditions that are required for success. Wool was exported in 1902 to the value of over £263,000.

The last industry to be mentioned is the winning of metals. Tasmania is so *rich in so many kinds* of ore that the *island has been called* a casket of precious stones. *The value of* mineral exports is about one and three-quar
lions annually, with every prospec
increase, both by improved met
winning and the discovery of fresh
as large parts of the country, a
known to be metal bearing, hav
been prospected.

## GENERAL.

The present is a good time to br
der public notice the many adv
possessed by Tasmania The ben
intercolonial freetrade are already
able. New businesses are springi
land is increasing in value, and
of other colonies are coming to Ta
In the present days of competiti
not sufficient to possess a good thi
it is absolutely essential that the
tages of this possession should b
known. There are so many parts
world, less blessed than Tasmani
large populations, hardly able t
a living, while in Tasmania there
for a very much larger populatio
should be our endeavour to make
the advantages possessed by Ta
This subject has been mentioned o
occasions, and was especially refe
at our last meeting. It is not
indiscriminately invite all sorts of
to come to Tasmania, or to any oth
of the world. It has also to be b
mind in coming to a new count
new experience is necessary. Exp
gained in large communities o
countries may be of value, but
launching out in a new country it
solutely essential to obtain a kn
of local conditions. In agricultur
suits, for instance, climate and so
be thoroughly understood. The
ance of Government to newcomers
essential. There are plenty of
tunities in Tasmania for the new
who is determined to make his hom
and to succeed. This they will d
out assistance, either from the
ment or from anyone else But it
eminently a thing that the Gove
can do through an Agent-General o
means; namely, to disseminate
information as to the many adv
that Tasmania possesses—in positi
mate, soil, water power, civilisatio
in growing industries. Streams
grants are going to many countrie
England. Very few of them are
to Tasmania. In the other colo
the present time, many people ar
ing for a new home, undecided w
go. From the prominence given t
Africa in the papers many have
to go there, who might have come
mania at less risk, less expense, an
good chances of success had the
tages of Tasmania been more
known.

losing I venture to express a hope he discussion on this paper may o a wider knowledge of Tasmania, ould suggest, as a further means to me end, that it would be useful if lets were written on Tasmanian d fisheries, from a sporting, and n industrial point of view. Also, ld be very desirable that the technical side of our Museum should be ed by exhibits of—

els of fruit, vegetables, and roots.

bits of cereals, grasses, and hops,

bits of biscuits, bricks, blankets, candles, flannels, fruit (dried and ed), canned fish, furs, furniture, , soap, wood carving, and other les of Tasmanian manufactures.

paper was illustrated by over 40 slides, prepared by Mr. Beattie, at. Oldham manipulating the lan-

President warmly commended the and suggested that the discussion menced that evening, and continu- a subsequent meeting.

Bishop of Tasmania said it was ned that the State required more tion, although he was told that nia contained more population per mile than the other States of the nwealth. He referred to the large maintaining roads in the country with such sparse populations. The hing applied to the railways, which, with a larger population, would be made to pay far better. Tasmania might be the Switzerland of Australasia, and to that end the natural beauties of the island should be preserved, to aid in attracting visitors. The Government did not seem sufficiently wide-awake to this point. Then there was room for manufacturing developments. Reafforestation was an important matter in some districts. He deplored (and he gave a striking instance in his experience) the difficulty of getting employment for men who came here, and wanted it. The question of increased population by extensive immigration was one in which the Labour Party did not agree. So there was a division of opinion about it, and he felt we do not want the immigration of millions; not numbers, but quality — people who could live decent human lives, and not be crowded out. (Applause.) People of such a class might be attracted to Tasmania, to the advantage of both themselves and the State, and to that end he suggested that a committee might be appointed in Tasmania and in England.

Mr. R. M. Johnston moved the adjournment of the discussion to a future meeting, which was agreed to.

## Constitution of the Society.

Mr. T. Stephens read a paper containing suggestions for improving the usefulness of the society. Discussion was left to a future meeting.

Votes of thanks to the readers of the papers terminated the meeting.

# ABSTRACT OF PROCEEDINGS, JUNE, 1903.

A meeting of the Royal Society of Tasmania was held at the society's room at the Museum on Tuesday evening. His Excellency the Governor presided.

### Exhibits.

Amongst the exhibits laid on the table was a memorial volume of the late J. B. Walker, published under the auspices of the Royal Society of Tasmania. The volume contained all the papers read by the late J. B. Walker before the society. Another volume on view was "Notes on Early Life in New Zealand," by the Rev. Geo. Clarke, presented to the society by the author.

### New Members.

The following were elected members of the society:—Messrs. E. D. Dobbie, E. H. W. Wolfhagen, M. M. Ansell, E. Hawson, and N. Oldham.

### Discussion.

A paper previously read by Mr. A. O. Green on "Tasmania from a Manufacturing and Immigration Point of View, and her Natural Advantages," was discussed.

Mr. R. M. Johnston said he was in accord with Mr. Green in his view of the possibilities and natural advantages of Tasmania, and approved of his caution with respect to the class of immigration that should be encouraged. Great caution must be exercised in the number of immigrants introduced at any one time, and attention must also be paid to the class of immigrants. Although a very large number of persons emigrated annually to the United States, it formed a very moderate proportion in comparison with her population of 64 millions. If the same proportion came annually to Tasmania, it would mean only 1,132 persons a year. He agreed with Mr. Green that unless the immigrants were drawn from the agricultural class, the annual introduction of such a number would have a bad effect on the local labour market. The standard of living in Australia was higher than in the United Kingdom, France, Germany, United States, etc., and still a smaller number of days was absorbed in Australia in earning that higher standard of living. The purchase of power in Australia was, therefore, greater, but the cost of living was high. Mr. Johnston then quoted the chief articles of food used in each country, and gave the prices of each article. The success of a young colony depended largely on the extent of land opened for settlement, and success also depended to a great extent on such things as the agricultural, pastoral, and mineral industries. A young country passed through three great successive predominating stages. The first was the pastoral stage, the second was the agricultural industry, and the last the manufacturing stage. This last stage was still far off, as far as Australia was concerned. The pastoral and agricultural industries could not support many people to the square mile. For every 1,000 additional labourers that could be placed on the land, nearly 7,000 additional persons could be kept in the State. Referring to the question of population, Mr. Johnston said in the last century the United Kingdom could only double its population in 71 years, Australia in 11 years, and Tasmania in 16 years. During the last decade the increase of population was such that it would take 93 years for the United Kingdom to double its population; it would take Australia 39 years instead of 11, and Tasmania 42 years instead of 16 years. The serious decline in the increase of population was a strong reason for caution being exercised in forming any estimate of the likely growth of population in the present century. If the present increase of population was maintained, Tasmania, that now had a population of 177,000, would in 2002 have a population of 900,810 persons. It was possible that such a growth would be maintained, having regard to the fact that America in 30 or 40 years time would, instead of absorbing the surplus population of the United Kingdom and Europe, be really augmenting the immigration to Australasia. Supposing that the present rate of increase in population in Australia was maintained, there would be in the Commonwealth in 2002 a population of 21,585,000. The mass of the people in Tasmania lived in a better condition than in the United Kingdom, and the fact that fewer families lived in one room conduced to a healthier life..

Mr. T. Stephens also offered a few remarks on Mr. Green's paper, and pointed out that the suitableness of the soil in Tasmania for potato-growing applied only to certain districts. It was astonishing in a country like Tasmania, where hundreds of tons of apples wasted every year, that more cider was not made. He thought lecturers should go through the United Kingdom, giving the people accurate information of the prospects that awaited them in Tasmania.

His Excellency, in calling upon Mr. Green to reply, said he had understood that gentleman to state that in England mutton could be obtained at 2½d. per lb. That was quite contrary to any experience of his, and he would be glad to hear how Mr. Green had been so fortunate as to obtain his mutton in England at so low a price. (Laughter.)

Green expressed pleasure that his
had drawn such useful information
at advanced by Mr. Johnston. The
n to which he had referred as being
asable in England at 2½d. came
New Zealand, and he had been in-
d that it could be purchased as low
.

### Mount Elephant.

nel Legge read a paper on "Mount
ant and its Limestone Beds," and
ade reference to the coal obtained
vicinity.

paper was discussed by Messrs.
. Johnston and T. Stephens, after
Colonel Legge replied.

### Rainfall at Great Lake.

nel Legge read a paper, written by
lf and Mr. Kingsmill, on "The rain-
d water supply of the Great Lake."
aper stated that the character of
untry at the North was totally dif-
from that at the South. Atten-
ras paid to this feature, owing to
despread idea that the Great Lake
o feeders, and that the outflow
h the Shannon at the south end was
nsated for by the influence of
s at the bottom of the lake. Re-
e was made to the extent of the
rainfall between the south end of the lake (Swan Bay) and the Little Lake at the north. The difference in the fall of rain at the two places was caused by the proximity of the north end of the lake to the high mountains of the Western ranges, which caught all the rain coming from the west and north-west. The extent of the fall of rain in various parts of the neighbourhood was explained, and attention directed to the effect exercised by the adjacent mountains on the precipitation of rain around the head of the lake. It was thought that, though there were no large feeders at the north of the Great Lake, the rivulets that did exist carried a large body of water to the lake after heavy rain, and the climate was so wet that the discharge from the surrounding mountains was of frequent occurrence throughout the year. The conditions which affected the water supply of the Great Lake were—A wet climate at the north end; a watershed of mountain rivulets; repeated heavy falls of rain; melting of snow; the normally small outflow at the south end.

Votes of thanks were accorded the writers of papers.

Discussion of the paper was postponed until next meeting, and His Excellency was accorded a vote of thanks for presiding.

## JULY MEETING.

Owing to heavy rains the meeting lapsed.

## INTERESTING PAPERS.

At the monthly meeting of the Royal Society of Tasmania on Tuesday evening, August 11, His Excellency the Governor (Sir Arthur Havelock) presided.

## CONTRIBUTIONS TO THE PHYSIOGRAPHY OF TASMANIA.

### No. 2.

## RAINFALL AND WATER SUPPLY OF THE GREAT LAKE.

(By Mr. H. C. Kingsmill and Colonel Legge, R.A.).

In March last, a trip for scientific purposes was made by us to the Great Lake, and, as part of the work, we undertook the investigation of the supply of water flowing into the lake at the north, and mountainous, end. As is well known, the character of the country at the north is totally different from that at the south: the bare plains and barren hills of the latter giving way to the bold ranges of rocky mountains and glades and valleys of damp, boggy soil, which constitute the reverse slopes of the Great Western Mountains.

We were induced to pay attention to this subject owing to the wide-spread idea that the Great Lake has no "feeders," and that the outflow through the Shannon at the south end is compensated for by the influence of springs at the bottom of the lake. We would here remark that, from the results of our numerous soundings all over the lake, no bottom is more unlikely to contain springs.

As the result of a previous visit by one of the writers to the lake, a meteorological station was established at the north end, under the care of Police Trooper Archer. Observations commenced at the Little Lake in June, 1902. In that we now have a year's record, revealing one of the most interesting cases of great variation in rainfall between two contiguous stations that can probably be found in Tasmania.

As "the crow flies," the distance between the south end of the lake—Swan Bay—and the Little Lake at the north end is about 15 miles. At the former the rainfall was 18.0 inches during the 12 months ending May 31, and has averaged 33.87 inches during the past years; while our record at the station on Little Lake for the same period—June 1, 1902, to May 31, 1903—reaches a total of 63.62 inches.

This remarkable difference in the fall at the two places is caused by the proximity at the north end of the lake to the high mountains of the Western Ranges, which catch all the rain coming from the west and north-west, and precipitate it on the watershed between Dry's Bluff, with its contiguous mountains and the lake shores. Although this watershed is one of inconsiderable depth, measuring from north to south, it is traversed by several not unimportant streams, which lead to the lake in a belt of only about four miles in width.

After a heavy night's rain, with a fall of two inches, which is of frequent occurrence, these streams come down in high flood, which, from observations we made, lasts two or three days, and pours an immense body of water into the lake. This is especially the case as regards the principal "feeder"—omitted for some unexplained reason from the maps—and which we are desirous of naming the "Shannon Rivulet," as it may be considered as much a part of the Shannon as the upper portions of the Shannon River in Ireland, before it flows through the splendid lakes which are renowned for their salmon fishing. The rivulet in question rises in a locality called by shepherds, "Half Moon Marsh Creek," little above the Pine Lake on the crest of the Great Western Mountains, and flows through the Half-Moon Marshes, and into the Little Lake, which empties by what is known as the "channel" into the Great Lake.

As illustrating the effect of one of the heavy downpours which are frequent at the north end, while there is scarcely any rain at the south, we may mention that on the night of March 2, we were camped at the Little Neck, which is half-way down the lake. It commenced to rain about 11 o'clock, the fall being by no means heavy—a steady rain, with moderate breeze from the north—and continued till 9 a.m. next morning. At this time a strong north-west wind was blowing, against which we had to pull in a heavy sea most of the day before we could get into position to sail home. On our arrival at the north end, we were met by the dark, peaty waters of the flood from the Pine Lake, about three-quarters of a mile from the shore, and reached our landing place in the channel with much difficulty. We found that there had been heavy downpours of driving rain, commencing earlier than with us, and continuing without intermission till 11 a.m. the next morning, the fall registering by 9 a.m. inches.

At the Little Neck, 10 miles south, we

had had a moderate rain of about 70 points at the most up till the time it ceased. At Tinder Bay, about 30 points were registered.

This is, doubtless, a fair instance of the locally heavy rainfall at the north end, and shows the effect the adjacent mountains have on its precipitation around the head of the lake. Four miles to the north, at the Pine Lake, the source of the Shannon Rivulet, the fall must have been much greater, as is proved by the heavy flood which came down this stream about 1 o'clock on the 4th.

The four principal streams, which drain the watershed above the lake, are, commencing at the east—firstly, Breton's Rivulet, which rises in the Dry's Bluff region, and has a southerly course of about 10 miles, until it flows into the lake about a mile to the east of the channel; secondly the Shannon Rivulet, flowing out of the Pine Lake, passing through the Half Moon Marshes, and taking up several tributaries before it reaches the Little Lake, which discharges by the channel into the lake — these tributaries rise in upland marshes which discharge large bodies of water after a night's rain; thirdly, a small stream, Kimberley's Creek, which drains several marshes, and rises in hills to the north, not far from the source of the Shannon Rivulet. This creek falls into the lake a mile to the westward of the channel. Fourthly, Pine Creek, which comes down the valley at the north-west corner of the lake, and through which the track passes to the Nineteen Lagoons. The course of this stream turns northwards at some distance from the outlet, to high marshes, where it rises, and at its bend is joined by a tributary called Kermode's Rivulet, flowing from the slopes of the Stony Tier, a bold and rugged range, dividing the lake valley from the Ouse and Nineteen Lagoons district. Futher south on the lake shore, about two miles, there enters a fifth stream, Brandum's Creek. This, and one or two still smaller creeks to the north of Reynold's Creek, flow from the eastern face of the Stony Tier.

At first sight, this lofty range would appear to furnish an important watershed, and the smallness of the creek flowing from its slopes surprises one. The reason, however, is plain, inasmuch as the range lies out of the track of the heavy north-west rains, and its sides, like those of the Sand Bank Tier, on the east shore, are mostly bare and made up of large fields of talus, in comparison to which the Ploughed Field of Mount Wellington is a pigmy. Consequently the water from heavy falls of rain rushes down at once to the lake, and there is no lodgment in marshes and small morasses as along the north side of the water. In fact, along this shore of the lake, as on the north, numberless rills and streamlets intersect the boggy slopes leading from the mountains to the shore, and materially help to augment the inflow after heavy rain.

On the eastern shore, between Breton's Rivulet and the large bight at the foot of the Sand Bank Tier, there are no creeks of any consequence until the north-east corner of the bight is reached, where there is a stream, bridged over by the Government, which carries a good flow of water after heavy rain, but normally has but little water in it. It is to be regretted that no opportunity was afforded us of gauging this creek. Beyond this at the southern corner of the bight, there is Boggy Marsh Creek, still smaller; but further south there are no creeks of any consequence, and the rainfall becomes very much reduced the more one approaches the extreme south of the lake.

On the slopes of the Sand Bank Tier, the fields of talus are more gigantic than on the Stony Tier, and there is no lodgment for water, with, also, less rainfall than on the latter.

From the above outline we think it may be gathered that, though there are no large feeders at the north of the Great Lake, the rivulets that do exist carry a large body of water to the lake after heavy rain, and that the climate is so wet that the discharge from surrounding mountains is of frequent occurrence throughout the year, except when the lake is frozen over. This happens every year between the latter end of May and the beginning of July; occasionally, however, a thaw sets in in June or July, and the ice is broken up by a gale, when the discharge into the lake from the melting snow, often 2ft. deep, is very considerable.

During our stay of a fortnight we found that the outflow by the Shannon at Swan Bay was very small, and that the many falls of rain at the north end had very little effect on the water level at the south end, only raising it a few inches. The Shannon is dammed up half a mile from the outlet, so as to keep the water in Swan Bay at a convenient level for fishing purposes. The dam has recently been broken by ice floes in the spring, and at the time of our visit had been repaired. The water flows through the stones, there being no "spill," and below the structure, where we could get a good section, the stream was gauged.

The effect, however, which a strong wind, blowing either north or south, has upon the lake level at the opposite end, is remarkable. The lake being very shallow, in proportion to its great area, and the bottom being so extraordinarily level, a sea rises in a few minutes, one might almost say, and the water being forced through the straits, formed by the remarkable peninsulas — locally called "necks" — which are characteristic features of the lake, a rise of over a foot takes place at the extreme ends, after a moderate gale only. This does not affect the question before us, but it was thought it might be a fact of interest to the Fellows of the Society.

The gauging of the streams was taken with a current meter, kindly lent us by the Government Hydrographer of New South Wales, Mr. Halligan. Sections of the stream beds were carefully taken, a site being selected in each case where the bottom was even, and in the case of the larger streams the current was taken at the surface, a foot below it, and near the bottom, and the mean taken as the velocity.

Where it was not practicable to measure the depth at intervals right across, the depth in the centre was estimated proportionately with that near the sides. In every instance care was taken not to overestimate the depth, so that the calculated volumes may be taken as rather under than over the actual ones.

It was thought advisable to ascertain the quantity of water the "feeders" at the north end were capable of supplying to the Lake; we, therefore, decided to gauge them shortly after the flood of the 3rd March, alluded to above. A commencement was made with the "channel" the following day, 22 hours after the fresh was at its height.

The following table gives the result of our measurements:—

Channel from Little Lake. — Time after height of flood, 22 hours. Velocity per minute, in feet, 156. Volume in gallons per minute, 66,812.

Breton's Rivulet, 24 hours, 150ft., 31,171 gals.

Kimberley's Creek, 27 hours, 140ft., 6,344gals.

Pine Creek, 28 hours, 147ft., 34,912gals.

Brandum's Creek, 29 hours, 86ft., 2,150 gals.

Total flow in gallons per minute, 141,389.

Total flow in gallons per 24 hours, 203,000,000.

The following day the Shannon Rivulet was gauged about the Little Lake, to ascertain the quantity of water flowing into the latter from this stream, exclusive of that from the many small rills intersecting the marsh land at the foot of the Fluted Tier, overlooking the lake. The Little Lake channel was also gauged. The following were the results:—

Shannon Rivulet—Time after height of flood, 48 hours; velocity per minute in feet, 130; volume in gallons per minute, 46,919.

Little Lake Channel, 46 hours, 127ft., 48,218gals.

On Saturday, the 7th, the fourth day after the flood in the north, we gauged the Shannon below the dam. Some difficulty was experienced in getting a good section, owing to the stony nature of the bottom. We chose a spot where the river was 24ft. wide, and the depth 9in. The result was as follows:—

Shannon River—Time after height of flood, 4 days; velocity per minute in feet, 84; volume in gallons per minute, 9,450.

Total outflow in gallons in 24 hours:—13,848,000.

We ascertained from the police trooper in charge of the meteorological station at Swan Bay, that the flood we had in the north had made very little difference to the lake level at the south end. It was estimated that the fresh would have taken about two days to reach the south, according to which our measurements would have taken about 48 hours after flood, although the actual date gives four days.

The conditions which affect the water supply of the Great Lake may, therefore, be summarised, in conclusion, as follows:

1. A wet climate at the north end, caused by the proximity of high mountains.

2. A watershed of mountain rivulets, which suddenly rise after torrential rains, and which flow through morass-land, holding large quantities of water in wet weather.

3. Repeated heavy falls of rain, which renew the large flow in the creeks, and compensate for the rapid subsidence of the floods.

4. Melting of snow, particularly at the north end.

5. The normally small outflow at the south end, owing to the conformation of the land at the river's starting point, and to the fact of its being dammed as well. This small outflow will compensate considerably for evaporation in the summer season.

Although the question of the lake water being utilised largely as an irrigation supply is beyond the provinces of stating that we take this opportunity of stating that in our opinion the shallowness of the lake, in spite of its large area, and the intermittent nature of its source of supply preclude the carrying out of any extensive scheme without interfering with the features of the lake, unless an embankment were thrown across the glade through which the Shannon commences its course.

The conditions which lead to this assumption are:—In the first place the lake is uniformly shallow; its three great subdivisions—North Lake, East Bight, and South Lake—are, on the bottom, level plains, with maximum depths of 16, 12, and 18ft. respectively; and the Middle Reach, north of South Lake, is shallower still; in the second place, the water entirely round the vast outline of the lake is so low that, at the time of our visit, the boat could in very few places be brought less than 30 yards from the shore. The water was, it is right to mention, 2ft. below normal level. At one spot, it was not a foot deep 600 yards from the shore, and in other places we had to wade 150 yards so as to land. The effect, therefore, of a heavy drain on the lake would be serious with a flat shore of this kind. We conclude with a few remarks on the practicability of using the lake as a reservoir.

The above-mentioned data and calculations will serve to show to what extent the lake acts as a reservoir, turning an intermittent supply into a constant stream.

During the night referred to above, on which we were camped at Kermode's Neck, over two inches of rain fell in a few hours at the north end of the lake, bringing the five principal creeks flowing into that end to a state of high flood. Twenty-four hours after the flood was at its height, the flow of the creeks was gauged; the flood marks would be seen far above the banks, but the creeks, though full, were within their banks.

It must be mentioned here that one creek had been gauged before the rain fell, viz., Kimberley Creek, and there the flow after the rain was fount to be ten times what it was before; the total inflow of all the creeks was about 100 times the inflow of the Hobart water supply at the Gentle Annie falls, just above the reservoir. In a very few days, doubtless the creeks would go back to the previous condition of discharging one-tenth that amount. Then another storm would come along, and another flood.

Let us consider how the outflow from the Great Lake would be affected by this intermittent supply. In the first place, we have the evidence of the Meteorologiial Observer at the south end of the lake that this flood at the north end produced no perceptible difference in the Shannon; we, ourselves, gauged the Shannon when we arrived there four days after the rain, and found the outflow from the Great Lake to be at the rate of 13,000,000gal. for 24 hours.

What then had become of the flood at the north end? A little calculation will serve to show: The area of the Great Lake is approximately 28,400 acres; 200,000,000 gal. spread over this area would approximately amount to a third of an inch in depth.

From this it is apparent that the great extent of the lake is quite sufficient to account for the equalisation of the flow of the Shannon, and its apparent indifference to an occasional flood.

Colonel Legge forwarded the following additional note:—

Please express my regret to His Excellency that I am not present to-night to take part in the discussion on the paper read last meeting on the Great Lake. I trust our investigations will at last throw some light on the vexed question of the supply of water to the Great Lake. Although there is, doubtless, a very heavy discharge through the Shannon in the winter from the lake, there is comparatively little when the water is at summer level, as our investigations show 203,000,000 gallons flowing in during rain, and 13 million flowing out under like conditions, for 24 hours. Therefore, in connection with the use of the lake as a reservoir the question to be considered is loss of water in the summer by evaporation and absorption. The suns rays are powerful in the rarified atmosphere of the lake, and the loss of water from these latter causes is forgotten, more than that by overflow. This is proved by Mr. Buckley, C.S.I., in his interesting paper on the East African Protectorate to be a very important factor in the case of Lake Victoria Nyanza. The maximum discharge from it by the Nile, over the Ripon Falls, is shown to be 30,000 cubic feet a second, which only lowers the lake level about 1¼ inch in a month. On the other hand the reduction in the lake levels is at times so considerable, as shown by the "greoges," that after deducting the loss for overflow at the above amount, it leaves a balance of 7 or 8 inches a month to the effect of evaporation. This astonishing difference is due to the tropical sun, in spite of the large area of the lake, which is more than 2,000 square miles larger than Tasmania, but these results must convince one that even in the lesser degree, due to climate and small size of the Great Lake, the loss in summer by evaporation is very considerable. It would not be difficult to estimate it, if gauges were fixed up by the Government at the Lake. The results would be more interesting to students of the Physical Geography of Tasmania, if to no one else.

Mr. Kingsmill, in opening the discussion, said they had been told there was a great hole somewhere in the Great

Lake, but they were unable to find it, the greatest depth found was 20 feet. The bottom of the lake was level, covered with blue mud. There were three very remarkable islands in the lake. He described the lake and its surroundings from a geological point of view. The rock walls on the shores of the lake constituted a remarkable formation.

Mr. R. M. Johnston said Col. Legge had placed him in possession of several rocks from the shores of the lake, all more or less weathered portions of basalt, of recent eruptive rock, often remarkable for showing structures of radiated pillars. No doubt there had been a damning up of recent eruptions of basalts at the eastern end. He was surprised that a greater body of water was not discharged all the year round from such a large area. He warmly commended Col. Legge's paper as a very valuable one to this community. (Applause.)

His Excellency thought that if Mr. Kingsmill could give them some information as to the waters of the lake in relation to irrigation, it would be useful.

Mr. Kingsmill replied that it was his first visit to that country, and he had not the opportunity of making extended observations. The head waters of the Ouse flowed past the Great Lake, and that river carried a much larger volume of water than the Shannon, which flowed out of the Great Lake. He thought that the waters of the Ouse might be diverted into the Great Lake, and thus a much greater volume of water would flow out of it. It was a question of levelling and surveying. There must be a rapid fall down the valley of the Shannon, which might be made available for water power.

### "Agronomy in Relation to Science."

This was the subject of a paper read by the Rev. E. H. Thompson, in which he advocated a systematic nomenclature of our fruits, notably apples and pears, showing how useful a recognised system of nomenclature would be in many directions, particularly in connection with ordering fruit trees true to name, and in marketing as well as manuring, and otherwise cultivating these fruits. A botanical classification would help to reliably observe and determine the various processes of fructification and pollination, and the relation between scion and stock, a subject, he said, about which we practically know nothing, but which *must exercise* a marked influence on the fertility and vigour of the trees
suggested a section of the Royal S
dealing with such matters.

Mr. Thos. Stephens sent in som
on the same subject, commendin
E. H. Thompson's paper, and em
ing the importance of it. He hop
suggestion of forming a section
Royal Society would be carried c

Mr. L. Rodway emphasised t
portance of improving our fruit,
ally seeing that the industry had i
ed to the output or marketing of
a million cases a year. The kno
Mr. Thompson intimated was of
difficult nature to acquire. The G
ment should establish a central
for the teaching of agricultur
fruitgrowing. There should be a
orchard for experiments, and th
parting of knowledge connected
with. It was very unfortunate t
regard to fruit we had to depe
largely on popular names. The
tainly should be wax models o
principal fruits, correctly forme
coloured, placed in the Tasmania
seum—(applause)—and growers m
name their fruits in accordance
such models. (Applause.) Mr. T
son's remarks about the importa
cross-fertilisation he supported, es
ly in connection with the incre
both quantity and quality of frui
shy bearers. It was to be hoped t
vernment would take the matter
a branch of technical education.
plause.)

Rev. E. H. Thompson, in re
said there was hardly an apple
in Tasmania that was correctly a
finitely named by growers as a b
the Royal Society could not es
a section as he suggested, then a
logical Society should be formed w
delay. (Applause.)

Mr. R. M. Johnston was su
that such a society had not alread
formed.

## FLOWERING PLANTS AT KETTERING.

Mr. R. M. Johnston, F.S.S., p
ed a paper, dealing with the chara
tic plants of Kettering and its in
ate vicinity, containing a classifi
of plants collected within the lin
the township in the month of Nov
1902. The greater part of the
and herbs were in flower, and the
tions, although far from comple
said, must be regarded as especia
presenting the characteristics

flora of this beautiful seaside locality. No less than 130 species were described.

Mr. Morton hoped the above would be the first of many lists of local plants the society would receive. Teachers of schools might prepare lists with great advantage.

His Excellency, in moving votes o thanks to the readers of papers, said h regarded Mr. Thompson's paper as a extremely valuable one, and he truste it would be printed, and widely circulated. (Applause.)

The vote of thanks was passed, an the meeting terminated.

## PAPER READ BY THE BISHOP.

A meeting of the Royal Society of Tasmania was held on Tuesday evening, in the society's room, at the Museum. His Excellency the Governor presided, and there was a moderate attendance. An apology was read from Sir Adye Douglas, who was unable to attend.

The Secretary (Mr. A. Morton) read a circular letter from the Premier relative to the proposed celebration of the centenary of Tasmania.

The Mayor (Alderman Bennison) explained that he had discussed the matter with the Premier, and the latter stated that he had not yet received replies from all of the public bodies to whom the circular had been sent.

It was decided that the letter should be acknowledged, and that the Premier be informed of the society's willingness to co-operate in the movement.

Mr. T. Stephens presented to His Excellency, on behalf of the society, a volume of the proceedings of the society for the year 1902, which was the diamond jubilee of the Royal Society of Tasmania. The book contained a portrait of His Excellency.

His Excellency thanked Mr. Stephens and the members of the society for the presentation.

Dr. Naylor and Mr. K. L. Murray were elected members of the society.

## THE DECIMAL SYSTEM, AS APPLIED TO WEIGHTS, MEASURES, AND MONEY.

(By the Bishop of Tasmania.)

My subject is one which would not be considered likely to arouse enthusiasm. And yet I hold that we should find ourselves decidedly enthusiastic on its behalf did we realise how practical and far reaching are the advantages which it has in view. My endeavour will be to show that I have warrant for holding this opinion.

It may be advisable to say a preliminary word or two about the obvious superiority *of decimals, as such, in comparison with their rivals, vulgar fractions.* The basis of our accepted scale of notation is the number ten. We derive it from the Arabs. It is not the only basis, for, apart from theoretical system of numeration, we find in our English tables of weights, measures, and coins, distinct applications of binary, duodecimal, and vigesimal factors. But the decimal basis is paramount, and governs not only the writing, but the language, of number. Reformers therefore unanimously turn to this basis when they devise plans for simplifying, methodising, unifying existing systems. When we come to divide the unit we may resort to fractions. So long as we are expressing whole numbers, we write them in a continuous line, giving a definite place to the units, tens, hundreds, and so forth. But when we write a fraction we break the line, and we introduce new methods for dealing with the numbers. But it is quite unnecessary thus to break the line. We have only to place what we call "the decimal point," and we can proceed as before, assigning their due places in the continued line to the divisions of the unit by ten, a hundred, a thousand, and so on. The operations for addition, subtraction, multiplication, and division thus remain unaltered. No new and complicated manipulations are called for, but merely certain easily learnt rules for dealing with the decimal point. Decimals, therefore, and not fractions, are the natural sequel to the study of whole numbers. They have the prior claim, both on logical grounds and on the ground of comparative simplicity.

Turning from these theoretical considerations, let us see how they find practical application in the matters before us. Nearly all the commercial communities of the old world have taken advantage of the merits of the decimal system to simplify their systems of weights, measures, and money. In these systems the unit, wherever it may be, is divided into tenths, hundredths, thousandths, or multiplied by ten, a hundred, or a thousand, and the resulting quantities are linked together into a definite whole by a simple but ingenious scheme of nomenclature. The French, with their usual love of clearness and order, have developed this decimal system most rigorously, and have set a standard which is fitted for universal adoption. I give the three principal tables which provide for all possible cases of measuring and weighing, whatever the material or the conditions may be, and however small or great the scale of operations.

Metric Tables of Measure and Weight.

Length.

Unit—The Metre: 39.37 inches.

Decimetre, Centimetre, Millimetre,

Metre,
Decametre, Hectometre, Kilometre.
Capacity.

Unit—The Litre: The volume of a cubic decimetre, a little less than the English quart.

Decilitre, Centilitre, Millilitre,
Litre,
Decalitre, Hectolitre, Kilolitre.
Weight.

Unit—The Gramme: Weight of a centimetre of water at 0 cent., 15½ grains Troy.

Deciligramme, Centigramme,
Gramme,
Decagramme, Hectogramme, Kilogramme.

For square and cubic measures, the metre and its parts or multiples may be squared or cubed, as in the case of English feet, yards, miles, etc. These beautifully inter-related tables almost explain themselves at a glance. I would merely draw your attention to a few of their principal features and merits. Note, in the first place, that the fundamental unit is the metre, which, like our yard, is now an arbitrary measure. It is employed to define both the litre and the gramme. There are only two other terms used; prefixes do the rest. In each table the prefixes are alike, and represent the same fractional parts or multiples of the unit involved. Those above the unit represent successively the tenths, hundredths, and thousandths of the unit. Those below represent successively the unit multiplied by ten, a hundred, and a thousand. The former set of prefixes follows Latin models, the latter Greek models; the two sets are thus sufficiently distinguished from one another, and are thus adapted for international use. We cannot wonder that this metric system has met with such wide recognition, not only for scientific and technical purposes, but as the working standards in the business life of well-nigh the whole of Europe.

The French coinage is also based on decimals. Taking the franc as a unit for purposes of calculation, the gold coins represent the value of 100, 50, 20, 10, or 5 francs. Among the silver coins, there are 5 and 2 franc pieces, the franc itself, and coins of the value of ½ and 1-5 of a franc. These are supplemented by bronze coins, which represent the division of the franc, the franc itself containing 100 centimes. The most usual of these coins are the 10, the 5, the 2, and the 1 centime pieces. We can perhaps best understand the system if we suppose our English sovereign to be divided into 10 florins, and the florin again to be divided into 100 centimes, the centime being thus nearly the equivalent of our present farthing. This supposition has also the interest of being one of the actual proposals for an English decimal coinage.

British Measures.

How terrible the contrast when we turn to our English tables. How we have to lower our heads with shame. Here are we, the greatest and most advanced of trading communities, saddled with systems of weights and measures which are the accidental outcome of centuries of casual developments, with no reason in them, no order, no method, no meaning. As children we struggle to learn them by heart. As soon as we leave school we begin to forget them. Most of us, except in the case of those tables which we happen to use in work or business, have to refer to printed authorities, or to skilled acquaintances, when we are called upon to calculate under their capricious rule. Do we want to measure a length? We toil painfully among leagues, miles (geographical, nautical, and ordinary), furlongs, poles, rods or perches, fathoms, chains, links, knots, yards, hands, feet, nails, ells, inches, till we are weary. Do we want to measure capacity? We must determine whether it is liquid or solid. If liquid, then we wade in a flood of tuns, pipes, hogsheads, barrels, kilderkins, firkins, gallons, quarts, pints (imperial and otherwise), gills, noggins, drachms, ounces, as they float past in tumbling confusion. If we want dry measure we jostle in the crowd of pecks, dry gallons and quarts, and the endless, but highly respectable, family of the bushels. For bushels trench also upon the province of the weights. And the learned tell us that a bushel of barley is 47lb. to 49lb., of coal is 80lb., of flour is 56lb., of malt is 40lb., of oats is 38lb. to 40lb., of rye is 55lb., and of wheat is 57lb. to 60lb. Do we want to weigh something? Then we wrestle, like intellectual Sandows, with tons, hundredweights (which are really hundred-and-twelve weights), quarters, pounds, ounces, drachms, pennyweights, grains, in motley array. There are further complications. A load may be 1,296lb. or 2,016lb., according to the kind of coal; the pound may be 16oz. or 12oz.; a stone may be 8lb. or 14lb., but in cheese 16lb., in glass 15lb., in hemp even 32lb. In dealing with wool the elastic stone is 14lb. for the grower, but 15lb. for the wool stapler. And so on, and so on. I do not know if Tasmanian apples have yet achieved the distinction of having a peculiar measure of their own. Even if this is not as yet the "case," the meaningless jumble of terms makes us pause to take breath. They are the belated outcome of British "common-sense"; they tyrannise throughout the greatest Empire the world has ever seen. In spite of the space required, I cannot refrain from giving a few typical instances, because an appeal to the eye so powerfully reinforces the appeal to the ear. As a neat specimen of what simple subtraction may become, take the following:—

| | Miles. | Furlongs. | Rods. | Yards. | Feet. | Inches. |
|---|---|---|---|---|---|---|
| I.— | | | | | | |
| From | 1 | 0 | 0 | 0 | 0 | 0 |
| Take | 0 | 7 | 39 | 5 | 1 | 5 |

I leave you to find your own answer.

Let us take a fair specimen of calculations of price. I quote from a set of comparative sums—

II.—Give the cost of 215 tons 17cwt. 3qr. 9lb. at £9 11s. 6d. per ton.

```
Cwt.           T.cwt.qr.lb.       £ s. d.
 20            215  17  3  9      9 11  6
  4             20               20
 --           -----              ----
 80           4317               191
 28              4                12
----          -----              ----
640           17271              2298 pence
160              28
----         ----------
2240lb. per ton. 138177
                 138177
                  34542
               ----------
                 483597
                   2298
               ----------
                3868776
                4352373
                 967194
                 967194
               ----------
               1111305906

    224,0 ) 111130590,6 ( 496118  pence
             896
            -----
             2153
             2016
            ------
              1370
              1344
             -----
               265
               224
             -----
               1950
               1792          158  3
             ------          ---  -
                158          224  4
             ------
    12 / 496118
         ---- 
    20 /  4134,3-2
         --------
        2067—3  Answer:  £2,067  3  2¾
```

Ah, you say, but let us work it by *practice.*

III.—

| | £ | s. | d. |
|---|---|---|---|
| 215 tons at £9 per ton... ... ... | £1935 | 0 | 0 |
| ,, ,, ,, 10s. ,, ,, ... ... ... | 107 | 10 | 0 |
| ,, ,, ,, 1s. ,, ,, ... ... ... | 10 | 15 | 0 |
| ,, ,, ,, 6d. ,, ,, ... ... ... | 5 | 7 | 6 |
| | £2058 | 12 | 6 |
| 215 tons at £9 11s. 6d. ... ... | £2058 | 12 | 6 |
| 10 cwt. ,, ,, ... ... ... | 4 | 15 | 0 |
| 5 cwt. ,, ,, ... ... ... | 2 | 7 | 10½ |
| 2 cwt. ,, ,, ... ... ... | 0 | 19 | 2 |
| 2 qr. ,, ,, ... ... ... | 0 | 4 | 9½ |
| 1 qr. ,, ,, ... ... ... | 0 | 2 | 4¾ |
| 7 lb. ,, ,, ... ... ... | 0 | 0 | 7¼ |
| 2 lb. ,, ,, ... ... ... | 0 | 0 | 2 |
| | 0 | 0 | 2 |
| Answer ... ... ... ... ... ... ... | £2067 | 3 | 3 |

This method certainly saves figures. But the saving is effected at the cost of much advanced and sometimes trying mental work, and by much artificial condensation of statement.

Let us look at a similar calculation on the metric system.

Take the same sum as stated in terms of decimal weight and coinage.

IV. Give the cost of 219,817 kilos at £9—4fl—4c. per 1,000 kilos.

```
   219.817
     9.404
 -----------
    879268
   8792680   Ans.: £2,067—1fl.—59c.
 1978353
 -----------
 2067.159068
 -----------
```

Note the conciseness of this calculation, its absolute simplicity, and its accuracy. For, with all their elaboration, the other two methods did not give results which were quite accurate.

## Education.

After this comparative survey, let us try to realise what some of the practical effects would be if we were wise enough to adopt the decimal system. And first as regards the education question. We are beginning to feel the stress of foreign competition, and the value of education, primary, technical, and other, and yet we continue to waste the precious hours of school life on these needless and vexatious tables and calculations. Moreover, we put fractions before decimals, thus inverting, as I have shown, the natural and logical order. I feel that my lament on this score will go home to my hearers, unless they happen to have been born with a mathematical spoon in their mouths. For have not most of us suffered many things in our youth, and perhaps since, by reason of British arithmetic?

"Those vulgar Fractions broke our hearts,
And Practice drove us mad."

How many tears would have been unshed, how many causes of tears have been unfelt, if we had enjoyed the decimal system of weights, measures, and money! Educationalists draw for us touching pictures of the impressive simplicity of the arithmetic in the primary schools on the Continent of Europe, as compared with ours. And it is calculated by experts that under the metric system, children would save no less than one year of the time at present devoted to arithmetic—that is to say, they would save time sufficient to enable them to gain a fair knowledge of at least one modern language. And yet we profess to be keen in the cause of education, and to be earnestly solicitous for the welfare of the young.

### Commercial Loss and Gain.

When we recall the results of the comparisons we have instituted, special comment on the commercial aspects of our subject is hardly necessary. It is only British pluck that carries us through. Think of the grievous waste of time in British counting-houses and commercial centres—a waste which is increasingly serious, in proportion, as the competitive strain is more keenly felt. The thought of the unweildy cumbersomeness of our methods in conducting our home trade is enough in itself to make us agitate for reform. But what shall we say when we consider its effects upon our foreign trade? Our customers, who use the metric system, are estimated at 483,000,000. There are few of these who understand quotations and specifications based on British standards. And we are warned by our Consuls and agents in every part of the world, that the consequent hindrance to our trade is very real, and very grave. These decimal-using folk will not, or cannot, afford the time to work out intricate sums, and will not risk the mistakes which so easily arise in reducing the hopeless confusion of British tables to the metric standards. Consequently, they too often turn from us to Germans and others, whose quotations are clear and plain. Should the British manufacturer make a desperate effort to adapt himself to both sets of conditions, he has to increase his clerical staff, sometimes he has to keep double sets of costly patterns, and in these, and many similar ways, to handicap himself in his power to compete in foreign markets. For, with the partial exceptions of Russia and the United States, Great Britain, with her dependencies, stands alone in her system among the great trading communities with whom she chiefly has to deal. As a *good typical* example of what is at stake at home and abroad, I will quote from a paper read in Lancashire:—"The raw cotton, say, is bought in America, and invoiced in pounds; the freight is charged per ship tons, whilst the Liverpool charges and railway carriage are calculated per ton of 2,240lb. All the charges in the mill are again calculated by the pound, and when the yarn is sold by the merchant, or sold direct by the spinners to foreign markets, it will probably be invoiced in kilos. The carriage to the port of shipment is again charged by tons, hundredweights and quarters, the freight again by ship tons, and the railway carriage in foreign countries by kilos, same as the duty, etc., and all these calculations have to be made by the spinner or merchant. What a change if everywhere kilos, and kilos only, were the basis of calculation. What a saving in cost and brain power!

### Agitation for Reform.

The story of the agitation in Great Britain for reform on the lines of the metric system affords a striking example of British slowness and vacillation whenever the trouble of a change, however necessary and beneficial, has to be faced. The movement has been on foot among us for nearly 100 years, kept alive almost wholly by the zeal and perseverance of individuals and specially-constituted societies, hitherto without definite or solid success. Mathematical and scientific men have taken their own line, and for scientific, technical, and similar purposes the metric system is well-nigh supreme. But for trade purposes, save for certain departments of engineering, we are much where we were. At the same time there are signs of the growth of a more enlightened public opinion. In 1895 a Select Committee of the House of Commons itself recommended, "that the metric system of weights and measures be at once legalised for all purposes," that "after two years it be rendered compulsory," and that it be taught in all elementary schools, together with the early study of decimals. This committee received support from all manner of public bodies, city and borough councils, school boards, and the like. In 1898 the Commercial Department of the Board of Trade issued a most valuable report, containing, amongst other matters, a collection of "Opinions of H. M. Diplomatic and Consular officers" in regard to British trade methods. Extracts from 171 such opinions proved conclusively that "it is necessary for British traders to adapt themselves to the requirements of their customers." It is especially interesting to note that strong resolutions in favour of reform have come from such different and representative bodies as the National Union of Teachers, the Trades and Labou

Councils, the Manchester and Liverpool Chambers of Commerce, and even from one so official and correct as the Incorporated Society of Inspectors of Weights and Measures. Last, but not least, we record the fact that the Colonial Premiers at the late Coronation Conference passed a resolution that the metric system should be adopted throughout the Empire. And yet, with all this consensus of conviction and force of public opinion, nothing is done!

### Objection to Change.

Granted that there will, of course, be temporary difficulty and friction, why should we dread it? Others have faced it—among the rest no less a nation than Germany, and that, too, in recent years. It is easy to exaggerate this difficulty. All the European countries, save Russia, have effected the change without any serious opposition or inconvenience. Are we less intellectually alert and capable than they? The permissive period (fixed by the committee, as we saw, at two years) would be spent by all alike, teachers, parents, children, shop-keepers, in learning and teaching. They would all have the compulsory enactment in view. And when it came, they would be ready.

### Small Decimal Coins.

The only other objection of any force with which I have met, is the difficulty of adapting the smaller decimal coins to "retail trade." Some contend, and with a certain amount of force, that the poor lose by reason of the lack of binary divisions of certain decimal quantities. An example will show what is meant. Suppose that sugar is 25 centimes a pound, and that a small purchaser wants half a pound. Then either the shopkeeper must give way and accept 12 centimes, or the purchaser must pay 13 centimes. We know, from experiences of the fractional rise in prices which follows on a new tax, who will ultimately conquer. And it is asserted that the poor in some countries lose in this way 4 p.c. on their small purchases. This objection, however, is one of detail, and might easily be met. Moreover, it applies to coins only. And what is it, even at its worst, in view of the enormous mass of advantages that would be reaped by every section of the community?

### Conclusion.

Into such details as this last I have not entered. I have limited myself to general considerations. My present object will have been attained if I have succeeded in reviving and extending your interest in a *subject which must already* have engaged the attention of most thinking people. I trust that the new century will not have advanced far on its adventurous career before the British Empire has proved that in this matter of a rational system of weights, measures, and money, her claims to sound sense and to commercial adaptability will have been justified by fearless and beneficent reform. A system admirable for its simplicity, its completeness, its scientific and logical homogeneity, and its practical utility, lies close to our hand. Let no national prejudice, no fear of change, deter us from making it our own.

At the conclusion of his address the Bishop was warmly applauded.

His Excellency said the adoption of the decimal system was one that should be taken up. The only opposition he had ever heard raised to the system was one emanating from bankers. Still he had never been able to discover what that objection was.

Mr. R. M. Johnston, in response to a request by His Excellency, offered a few remarks on the subject. He said if it were not for the decimal system he would not undertake to do the work with one hundred men as he now did with two or three. Success could as easily be achieved in battle by bows and arrows as in the world's computation by adhering to the English system. It was not the schoolmasters who were to blame, but the standards of the English Universities. He blamed the universities of England, who set up such standards. Mr. Johnston then gave an illustration of his own methods of calculation. Children were too often taught figures parrot fashion, instead of by reason. Too much time was wasted in the present methods employed, and deprived children of an opportunity of learning other subjects. A bill had been placed before the Federal Parliament for the adoption of the decimal system. In the interests of the children the change suggested by the Bishop should be brought about.

Mr. A. Thorpe said that children could not be equipped with the marvellous instruments Mr. Johnston possessed, and he had hoped that the more simple methods would have been explained. Children should be taught to reduce shillings and pence to the decimal equivalent of a pound. Tasmania might be able to start a movement to induce the authorities to adopt the system.

Rev. H. H. Anderson, in reply to Mr. Thorpe, said he would never think of teaching a boy to do a sum in compound interest in any other way than by the decimal system. He believed that during the next few years mathematical teaching in the schools would be very different from what it was to-day. They desired that the mass of unnecessary work should be removed from the children, and he thought the University of Tasmania might do something in the matter.

Mr. C. J. Atkins pointed out a number of difficulties that he considered stood in the way of the metric system being adopted.

Mr. A. Morton referred to the fact of the metric system being in use at the Sydney University, and quoted remarks made by Professor Liversidge on the subject. He hoped that the Royal Society of Tasmania would help the matter forward.

Mr. T. Stephens explained that some years ago he had tried to induce school teachers to bring under the notice of their scholars the advantages of decimal and metric systems. It would be no use teaching children the metric system if it could not be applied in commerce and daily life. They should not cease their efforts to keep the subject prominently before the people, and try and bring about its adoption. He moved—"That copies of the Bishop's address be sent to the Hobart and Launceston Chambers of Commerce, and to members of the Federal Parliament, with a request that they should use their influence to see that effect be given to the valuable advice and suggestions contained therein."

Mr. R. M. Johnston seconded the motion.

Sir Jno. Dodds referred to the objections raised to the adoption of the metric system, and quoted Professor Liversidge's remarks on the matter. When the interests of a large manufacturing country like England were likely to be effected by the proposed change it was easy to understand the objections raised.

The Bishop briefly replied.

The wording of Mr. Stephens's motion was amended by asking the University of Tasmania to co-operate with the Royal Society on the subject, and unanimously agreed to.

His Excellency said the paper was one of great interest, and he felt sure that all would be grateful for the information given. He moved a hearty vote of thanks to the Bishop.

**The vote was carried by acclamation.**

# ABSTRACT OF PROCEEDINGS, OCTOBER, 1903.

The final evening meeting of the 1903 session was held on 11th inst., Mr. Bernard Shaw presiding. Owing to the inclement weather the attendance was limited. Among those present were:—Bishop Mercer, Messrs. R. M. Johnston, L. Rodway, C. B. Target, and A. O. Green. Prior to the business of the meeting being proceeded with, the chairman said he felt sure the members would agree with him in conveying to their friend, Mr. R. M. Johnston, their hearty congratulations on His Majesty's having been pleased to bestow on him the Imperial Service Order. Not only from Mr. Johnston's work as a Civil Service officer, but also from a scientific point, he (the chairman) could say that no one in Tasmania had worked harder than their friend. (Applause.)

The secretary referred to the work that Mr. Johnston had done during his residence in Tasmania. The secretary read extracts from Professor Judd, the late Sir Robert Hamilton, and the Rev. Julian Tenison Woods, in which the three named spoke in the highest praise of Mr. Johnston's work on the geology of Tasmania.

Mr. Johnston, in a few words, thanked the members for their kind reference. He (the speaker) felt proud of the high honour that His Gracious Majesty had been pleased to confer upon him.

## Papers.

In the absence of the author (Prof. E. G. Hogg, M.A.) Mr. R. M. Johnston read the paper entitled "The glacial beds at Port Cygnet." It was decided that discussion on this paper should be taken at a future meeting.

Mr. R. M. Johnston submitted some interesting notes on specimens of fossil flora and a fossil fish, discovered at Tinder Box Bay, and also some remarks on some fossil shells (Spirifer triangularis). A further paper by Mr. Johnston was read, entitled, "Notes on the Reidle Bay Conglomerates, Maria Island." The author said the chief object which he had in view in submitting this paper was to draw attention of the members of the society to a remarkable formation on the eastern side of Maria Island, between Ragged Head in the north, and Cape Bald in the southern side. It is not often, said Mr. Johnston, that local observers have the opportunity of visiting this remote spot, but, in the hope that others may aid in throwing more light on this interesting geological problem, he had specially drawn the attention of the members of the Royal Society of Tasmania.

Mr. L. Rodway read two very carefully prepared papers, dealing with some fungi found occurring in Tasmania.

Discussion followed at the close of each paper, the Bishop of Tasmania, Messrs. L. Rodway, A. O. Green, and others, taking part.

A vote of thanks to the authors of papers was proposed by the chairman.

The session of 1903 then closed.

# ABSTRACT OF PROCEEDINGS, MAY, 1904.

The monthly meeting of the Royal Society of Tasmania was held on Monday evening. His Excellency the Lieut.-Governor, Sir John Dodds, presided. There was a large attendance of members and members' friends, many ladies being present.

Mr. Thos. Stephens said it was his duty as well as his privilege, as senior vice-president and the eldest member of the Council present, to bid His Excellency welcome. They regretted very much the loss of their late president, Sir Arthur Havelock, but they, as fellows of the Royal Society, were only too glad to welcome, in his place, one who had filled the same chair before, and one who had always taken a lively interest in the business of the society. (Applause.)

Sir John Dodds said he thanked members most gratefully for the kind words of welcome which Mr. Stephens had spoken to him on their behalf. He assured them that he accepted the words of welcome with feelings of gratification, having the knowledge that they thought what he had been able to do was worthy of comment in that way. (Applause.)

An apology was received for the absence of Bishop Mercer.

## New Members.

Dr. Elkington, Dr. Gerard Smith, and Mr. E. C. Anthony were unanimously elected members.

## Paper.

Dr. Elkington read a paper on Some Relations of Insects to Human Disease." He said the subject upon which he had been asked to address them was one which had, within the past six years, produced a profound alteration in several branches of science. In Tasmania they were, fortunately, free from those scourges of humanity which were known to depend for their spread upon the agency of insect life, but even with us the problem was not wholly one of outside interest, as he would endeavour to show in relation to typhoid. In this case, however, the method of conveyance was purely mechanical, being due to particles of infected matter clinging to the legs and body of flies and other insects, and subsequently deposited upon food material, whence it was taken into the alimentary canal of the victim. It was advisable therefore to clearly distinguish between the two methods by which insects play a part in spreading disease amongst human beings; whether (a) as carrying agents pure and simple, the infecting agent undergoing no change, and not being dependent on the insect in any way; and (b) as bolts intermediary or definitive, the infective organism being dependent upon the insect, and undergoing an extra-corporeal phase of development in its tissues. The first group was of distinct importance from the sanitarian's point of view, as it taught us to guard against a real danger in times of prevalence of certain infectious diseases, but the second one far outweighed it. In the second group fell some of the chief scourges of mankind, in tropical regions at any rate, and of these the greatest was malaria. Next to tuberculosis, malaria was probably the greatest cause of death, and of ill-health, with which mankind had to contend. The proof of the conveyance of malaria by the agency of certain species of mosquitoes was to those who knew what the disease really meant, a fact of startling importance, presaging the approach of effective means of checking an enemy which, in the year 1897 alone, laid 75,821 British soldiers by the heels in hospital, out of a total strength of 178,000 odd in all India. He need hardly remind them how nobly the promise of that great discovery had been fulfilled, how "the white man's grave" of former years had become the white man's sanitorium, and how it was now possible for the march of Anglo-Saxon civilisation to progress in places where, even six years back, a newcomer could count his reasonable expectation of life on the fingers of one hand. Tropical medicine had assumed such great proportions that it practically formed the pivot upon which turned the whole question of European colonisation in the tropics, and, practically speaking, tropical medicine was very largely based upon the spread of disease by insects. There freedom from malaria practically meant freedom from ill-health. Havana had been cleared of that fell disease in 90 days, after it had had an uninterrupted reign of 140 years. The discoveries that had been made were, he trusted, but a foretaste of those which were to come. The work of Manson, Ross, McCallum, Reid, and others had revolutionised the methods of research into human disease, and there was little doubt that we were on the verge of further great discoveries, in which the lower form of life would be found to play an essential part in diseases affecting mankind. Dr. Elkington, with the aid of lantern slides, thrown on the screen by Mr. Nat Oldham, indicated the manner in which the discoveries were made, and showed how it was ascertained that the dappled-winged mosquitoes, which laid boat-shaped eggs, and had the oval cells in the stomach walls, were the developing parasites of remittent malarial fever. That mosquito belonged to the genus anopheles, being distinguished from the innocent culex species. He illustrated the difference, and said he had not come across a member of the genus in Tasmania, and though one species had recently been described in Victoria he had not come across any in that State, though he had made an examination of a large number. The mosquito might be killed by fumigation with sulphur or pyrethum powder. That, however, was an incomplete way, as since the anopheles bred by preference in small puddles and shallow stretches of weedy swamp, or slowly moving water free from small fish, its destruction was rather an engineering than a medical question. Much might be done by pouring kerosene or paraffin on the surface in the proportion of about a tablespoonful to every square yard of surface, so as to form a thin film, which clogged the air tubes of the larvæ and pupæ, and also probably killed the adult female while depositing eggs. That remedy would be found efficient by those who were worried by the local culices, which evinced a bloodthirsty disposition, in New Town, at any rate. Culex and anopheles larvæ, which were known to every boy as the "wrigglers," were found in every tank and pool in fairly warm weather. All species of anopheles did not carry malaria. Culices were especially fond of small collections of water, in pots and tanks — the saucer of a flower-pot on a window-sill might provide sufficient mosquitoes to make the inmates' life a misery, while an ordinary 400gal. tank would stock a neighbourhood. The notoriously malarious localities of Sierra Leone and Freetown, formerly known as "the White Man's grave," had, comparatively speaking, been turned into health resorts within two years of organised effort against mosquitoes, and in Ismalia, a previously notoriously malarial town, the average number of cases had been reduced from 2,000 to 200 per annum by one season's work. Practically, there were no fresh cases of malaria, once the work was got going, and it was now possible to sleep there in safety without a mosquito net, probably for the first time in the history of the town. To sum up the points, which he briefly indicated, the following facts had to be considered wherever malaria had to be dealt with:—There was, firstly, a blood parasite, which was the cause of the disease, and next came a particular genus of mosquito, whose tissues afforded the only place wherein this parasite could complete its life cycle. Malaria could be conveyed from man to man by injecting blood in which the organism was, but that need not be considered in practice. Therefore, in tackling the question of stamping out malaria they naturally attacked the mosquito. The adult insect might be guarded against by mosquito curtains, and other measures, to prevent its biting. The connection of yellow fever with Havana was almost proverbial. The average number of deaths from that disease alone was fully over 800 in each year, and it had been estimated that some 6,000 persons died of that disease in 1897, and, in addition, the island of Cuba, and adjoining parts of Brazil, acted as an endemic focus whence, at various times, the disease spread to many parts of the world, including Spain, Africa, and even England. In Rio, from 1868 to 1900, over 40,000 people died of it. The Southern States of America had also suffered dreadful visitations from it, so that we may easily understand why "Yellow Jack" was a decaded name throughout South America, the West Indies, and the Southern United States. With the opening of the Panama Canal, and the consequent shortening of the voyage from these localities to Australia, and the Far East, it was very probable that yellow fever would be introduced to this side of the world. Three or four years ago sanitarians regarded this possibility with awe and foreboding; to-day they looked upon it, certainly, as a serious problem, but as one which would give emphatically little trouble, compared to the introduction of a few cases of small-pox. Referring to sleeping sickness, Dr. Elkington said researches made by Dr. Castellani and others showed that the conveying agent in that case was the tsetse fly, previously well-known for the fatal effects of its bite on horses and cattle, but only lately known to be connected with disease in human beings. The curative agent appeared to be a form of organism known as trypanosome, or, as it should be more correctly termed, a herpetomonas, which lived in the blood and fluids of the victim. Dr. Elkington next touched upon the presence of plague in Australia, and said there was a growing tendency on the part of those who had to deal with the disease to regard more and more suspiciously the flea. A good deal of work had been done on those insects of late years, and more than 130 distinct species of fleas had been classified, and new ones were coming into knowledge month after month. Plague was, certainly, a disease of locality, and especially tended to infect those who sleep in such a locality, sparing those who move actively about during their visits, and sleep or rest elsewhere. It chose dark, squalid, vermin haunted vicinities, and avoided to a great extent any well-lighted places. Plague did not, apparently, thrive in the soil, nor was it known to enter the body with the food, in human cases at least. In the ordinary form — excluding pneumonio plague—it entered by the skin, and in the bubonic form, it certainly entered in the lymphatic area, drained by the first affected gland. Water played no part in its dissemination. Referring to the house fly, Dr. Elkington remarked that it was ubiquitous in its habits, and unpleasant in its history and associations, and, under experiments, it had been proved capable of conveying on its feet and body the germs of disease. In a more enlightened age the housewife would regard flies with the same horror and disgust as she now regarded bugs and fleas. He had little doubt that domestice flies, so-called, were responsible for a fair proportion of cases of communicable disease, especially, perhaps, of typhoid fever. Its possibilities, however, did not end there. Diseases especially, perhaps small-pox, might be readily conceived as spread by that means. He confessed, in fact, to a doubt as to whether the real cause of the aerial connections of small-pox was not partly or wholly due to insect life.

On the proposition of Sir John Dodds, a hearty vote of thanks was accorded to Dr. Elkington, and to Mr. Plate, for lending works of art to the society.

### An Ancient Tree.

Mr. R. M. Johnston exhibited a specimen of a piece of a tree which had been found embedded in the rocks near Barnes Bay (Southern Tasmania). He said the trunk of the tree from which the specimen was taken was from 15 to 20 million years' old, and was about 12ft. long and 18in. to 20in. in diameter.

## ABSTRACT OF PROCEEDINGS, JUNE, 1904.

The monthly meeting of members of this society was held in the society's room at the Museum on the evening of Monday, June 13. His Excellency the Lieut.-Governor, Sir John Dodds, K.C.M.G., C.J., presided, and amongst those present were the Private Secretary (Mr. F. Dodds), the Chief Secretary (Hon. Dr. McCall), Mr. R. M. Johnston, I.S.O., Dr. Gerard Smith, Mr. B. Shaw, Mr. G. E. Moore, and the secretary (Mr. A. Morton). Apologies for absence were intimated from Colonel Legge and Mr. E. A. Counsel.

His Excellency said: Before I call upon Mr. R. M. Johnston to read his paper, I propose to perform a very pleasant duty that has been entrusted to me. I have been asked to express, on behalf of this society, of which Mr. Johnston is a vice-president and distinguished member, the gratification with which it received the announcement that his long and most valuable services to the State had been recognised by his Sovereign, who had conferred upon him the Imperial Service Order. This Order was instituted by King Edward VII. on June 26, 1902, with a view of recognising faithful and meritorious service rendered by members of the administrative branches of the Civil Services of the various parts of the Empire. It consists of the Sovereign and the Prince of Wales and 425 companions, 250 for the Home Civil Service, and 175 for the Civil Services of the colonies and Protectorates. If we just think that of the enormous number of persons employed in the various colonial Civil Services throughout our great Empire, only 175 can become Companions of the Order, we shall realise how great is the distinction that Mr. Johnston has won for himeslf. The badge of the Order is a medallion of gold and enamel, bearing on one side the Imperial and Royal cypher, ond on the reverse "For faithful service," both executed in dark blue enamel on a plaque, or shield, of gold, surrounded by a wreath of laurel, surmounted by the Imperial Crown. We are very glad indeed that Mr. Johnston has received this proud distinction, because we know how justly it is deserved. Mr. Johnston's services to this State rank amongst the highest, because, in addition to their intrinsic value, they have been unceasing and patriotic. Coming to Tasmania nearly 35 years ago from Scotland, that country which has given so many splendid men to the service of the Empire, Mr. Johnston has devoted himself since with unflagging zeal and energy to the advancement of the interests of this State. He has thrown himself into his work with a disregard for all personal considerations, and his example of unselfish devotion to *his duties* and his high character have
exercised a beneficial influence in t
vice to which he belongs. Temptin
of more lucrative employment ir
States have been refused by him.
been true to Tasmania, and fait
her service in the highest degree.
simple, yet expressive legend, "Fo
ful service," inscribed on his Orde
aptly recognises his merit. Bı
Johnston's labours have not been c
to the routine of his official wor
has been indefatigable in the c
science. No member of this societ
its inauguration in the year 18
contributed a greater number of c
papers than Mr. Johnston, many c
being most valuable. He has ta
over a wide range of scientific kno
and has treated of natural l
botany, geology, palaeontology, eco
and other subjects. Probably his g
achievement is the splendid wo
titled "The Geology of Tasmani
first complete treatment of the
ever published. It gives us the re
years of patient investigation of t
logical formations of the island, a
monument of the author's untiri
dustry and proficient scientific kno
On its publication it was most
ably received by leading English,
pean, and American geologists. Pr
Judd, one of the most eminent of
English geologists, thus speaks o
important work in the pag
"Nature":—"But, quite indep
of the scientific value of
work, which, as we have se
certainly very great, we think t
vernment and people of Tasmania
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this remarkable and handsome v
It aims at being, above all thi
practical use, and its great object
direct the attention of colonists t
tions of pressing interest and i
ance. It is not often that the wa
the general public and of the sc
specialist have been so admirabl
or that a book has been produced
is at the same time accurat
thorough in its treatment of te
questions, while it is not wanting
more elementary details requir
those who have not had the advan
a scientific training." This bei
kind of service rendered, is it not
that the society that has received so
from him should ungrudgingly e
its pleasure at the distinction to
he has attained. I have not men
Mr. Johnston's personal qualiti
cause it is unnecessary. They are
known and appreciated, but I shou
to say that the actions of his life
to me to be governed by those pri
of justice and kindness towards
which God has established as th

true guides of human conduct. Mr. Johnston, I offer you, on behalf of the society, its most grateful thanks for all you have done for it, and its warmest congratulations on the honour that has been conferred upon you. (Applause.)

Mr. R. M. Johnston briefly returned thanks.

### Social Equality.

Mr. R. M. Johnston, I.S.O., read a lengthy paper on "Observations Regarding Some Economic Aspects of the Eisenach Social Equality Programme." The conclusions arrived at from his figures, he said, showed that wealth available for consumption and enjoyment was more equitably distributed than was generally supposed; and whatever might be its existing inequalities and defects, it was immeasurably superior to any scheme of communism or collectivism that had ever been attempted or formulated. The programme of the trades' unions and the more intelligent of the Labour Party in the United Kingdom and Australia were antagonistic to all the extreme communistic ideals of socialists. They, of course, advocated an extension of the idea of State censorship of the more important branches of industry; but it was on individualistic lines strictly, and not communistic—liberty, responsibility, skill, effective labour, and reward in accordance with ability, had ever been ideals of the best representatives of labour in England and in these colonies.

Mr. K. L. Murray moved the postponement of the discussion on Mr. Johnston's paper till next meeting of the society. He said that socialism was very little understood, and if the paper just read were widely distributed, it would do much to spread a knowledge of the subject. It had very much increased his knowledge, and he was sure it would do the same for anyone who studied industriously.

Mr. A. O. Green seconded the motion, which was agreed to.

### Preservation of Native Animals.

The Secretary read some notes forwarded by Mr. J. F. Mather to the Minister of Lands (Hon. C. Lyne) with reference to the reservation of Crown lands at Schouten and Freycinet Peninsula for the preservation of native fauna and flora. Mr. Mather wrote:—"The desirability of setting apart lands for acclimatisation purposes has frequently claimed public attention; but up to the present time very little thought has been bestowed upon the necessity for preserving our Tasmanian fauna; yet the emu is no longer found on the Tasmanian plains, and the forester is rapidly disappearing, whilst the black opossum has been so persistently hunted that it seems likely to also become 'a lost Tasmanian race.' In the interests of science, to say nothing of Tasmanian sentiment, our Government shoul
least one portion of this island
servation of native animals.
that we have now a Ministry c
Tasmanian-born Britishers, th
nity appears to be favourable
pressing the suggestion for a G
reserve for the purpose above
There is one locality excee
adapted for the end in view, vi
et's Peninsula and Schout
Scarcely any of the land is al
present, and nearly every varie
ing Tasmanian fauna is there
ed. Moreover, the lagoons ne
Island are breeding places fo
swan, and Schouten Island is
of many kinds of opossum. T
very little commercial value,
picturesque scenery, delightful
opportunities for fishing, the
unrivalled as a tourist resort.
to ascertain how much fencin
required to kep animals on Fr
ninsula, two members of a to
on March 8, 1904, stepped the
tween Meredith Fishery Bay, o
ern side, to Sleepy Bay, on
side. Starting from a point
bank, east from Swansea, the
decided to walk a course east
along the southern edge of a m
was then practically under wa
yards rising ground commence
was a gradual slope until the
reached at 1,300 yards, th
height being 150ft. above sea
scending thence for 220 yards,
minates on the granite cliffs
land, about the middle of
which cliffs are about 60ft.
the point at which the line st
Bay Coast the Lemon Rock
point S., and the northern he
glass Bay S.E. by S. half S.
northern head of Sleepy
east. The termination of t
Sleepy Bay may require abou
sonry to make this point quite
from the starting place on Me
ery Bay there may be necessa
yards of fencing to the rocks
water is deep. It is proposed
6ft. wire fence, using two w
rabbit-proof netting. The li
structed with timber, thoug
plenty of trees suitable for
immediate vicinity, and, appa
will be no difficulty in diggi
along the line indicated."

The Secretary also read a
the Minister of Lands, in wh
he was prepared to accede to
request, and was giving the
structions to the Secretary
arrange for the withholding f
selection the land mentioned
ton added that this was the
Australia that had not taken
preservation of its native fau

Mr. J. F. Mather gave a description of his visit to Freycinet Peninsula and Schouten Island, and Mr. J. W. Beattie showed some excellent views of Freycinet Peninsula and Schouten Island.

### Votes of Thanks.

His Excellency moved a vote of thanks to the gentlemen who had read papers, and to Mr. Beattie for his interest hibition of views. He expressed t that the movement set on foot Mather would be of a more per character than the effort made son ago to establish a reserve for a purpose on Franklin Island.

The vote was heartily accorded, meeting terminated.

# ABSTRACT OF PROCEEDINGS, JULY 11th, 1904.

The monthly meeting of the Royal Society of Tasmania was held at the society's room on Monday evening. The Bishop of Tasmania, Dr. Mercer, occupied the chair, and among those present were Dr. T. M. Hocken, F.L.S., of New Zealand, Sir Adye Douglas, Mr. R. M. Johnston, I.S.O., Mr. Bernard Shaw, Mr. L. Rodway, and the hon. secretary (Mr. A. Morton). An apology for absence was received from His Excellency the Lieut.-Governor, Sir John Dodds, K.C.M.G.

The collection of Meissonier's artists' engravings left to the Art Gallery by the late Mr. C. J. Barclay, and some Japanese paintings and embroidery work brought from Japan by Mrs. Hocken were on view, and were greatly admired.

### The Late Mr. C. J. Barclay.

The Chairman said that before proceeding with the business, he wished to refer to a late member of the Council of the Society, Mr. C. J. Barclay. Since the last meeting of the society that gentleman had passed away. Mr. Barclay had been, although he had not had the pleasure of knowing him especially in connection with this society, for many years connected with it. He was elected a Fellow of the society on the 10th of January, 1873, more than 30 years ago. He had always taken a keen interest in this institution, and he had bequeathed a large collection of Meissonier's artists' proof engravings. It was a most valuable gift; not only were they splendid engravings themselves, but the collection was one of the msot valuable gifts of art ever presented to their institution, and when placed in the gallery could not fail to be appreciated by the public. He was sure he spoke for all connected with the society when he expressed the profound regret at the loss they had sustained in the death of Mr. Barclay. (Hear, hear.)

### New Member.

Rev. Herman Ritz, M.A., was elected a member of the society.

### Social Equality.

Mr. R. M. Johnston further elucidated his paper read at last meeting on "Observations regarding some economic aspects of the Eisenach social equality problem." The discussion was further adjourned till next meeting of the society.

### Japan: Its People and Industries.

Dr. Hocken delivered an interesting address on this subject. He said: Whilst entirely appreciating the compliment of being asked to make a few remarks on the Forestry Department of Japan, I feel that they are scarcely worthy to be placed before your Royal Society, inasmuch as the notes and references I made were packed away some time ago with other material, and forwarded to Dunedin. Your secretary, however, seems always to be on the alert, and seeking whom he may devour, and it was he who beguiled me into a predicament, from which I can only escape by your courtesy and forgiveness. Within the last three years I have twice visited Japan, and a word or two upon certain features of that interesting country may interest you, and will not be entirely astray from our subject. It is but a short fifty years ago since the American Commodore Perry knocked at the gates of Japan—I had almost said with cannon ball. To that time the country had been almost secluded from commerce with the nations, and, content in its pride of ancient feudalism and curious semi-civilisation, it stood aloof from them. But when, in unmistakable, nay, threatening, tones the outside world said that this old order must change, and that Japan, geographically situated as it was, must no longer impede trade and progress, what was the result? Just such as our recently gained knowledge of Japanese character would lead us to expect. Though there were two parties, there was no indifferentism, laisez faire. Whilst one party sprang to the position at once, and saw that the only hope of safety and advance lay in accepting Western methods, and entering upon their civilisation, the other, the old warrior party, the Daimios of the Shogunati, were incensed beyond measure at the impudent threats of the foreigner. And though the barrier was thus roughly broken down, and the Americans and then ourselves began to enter, all was violent strife amongst the people themselves. Cries of "traitor" were incessant, civil war raged, assassination and murder, from which many of our own people did not escape, were common, and it seemed indeed as though the blessings of civilisation were to be anything but blessed—rather a curse. And then those terrible commotions began to cease, as they generally do, and gradually from north to south the people began to accept the teachings of the barbarian in thorough earnest, and we may date this time about the last 25 or 30 years. Since then their progress has been nothing less than marvellous. Their constitution is similar to ours—representative government, with an Upper and a Lower House. Railways run through the land. The steam services are amongst the finest in the world, notably the Nippon Yusen Kaisha, which trades fortnightly with London and some European ports, and monthly with Australia, or, rather, did until the present war. Numbers of their young men study at the various universities in Great Britain, America, and the Continent, and those of us who have had the pleasure of their acquaintance know what accomplished, well-bred men they are. In the capital of Tokio, which is one of the largest cities in the world, with a population of nearly 2,000,000, are now to be seen magnificent buildings, vieing with those of any capital whatsoever, dedicated to commerce, art, or government. This year the first electric tram service in the country has been introduced, and permeates Tokio in every direction. Of their courage and knowledge of the arts of war, I need not speak—the papers do that every day. And in this connection, one must refer to their humanity and their perfect system for the treatment of sick and wounded, equalling, if not surpassing, our own amongst the nations. Happy, I think, are we in having formed a compact or treaty with such a nation. Whatever be the immediate result of the present war, and I have little doubt as to that result, nor have the Japanese themselves, it bids fair to be in its ultimate results the most momentous perhaps that the world has ever seen, for it is the first trial of conclusions worthy of the name between the East and West. What must or may follow must give us pause. On several recent occasions I have heard the sentiment that if the Japanese were successful they would suffer from what is called with particular vulgarity, "swelled head," and would soon make an aggressive descent upon these colonies. I believe no such thing. They are a people of great modesty, and whatever pride they possess is one to which they are well entitled, and which they have thoroughly earned. Theirs are the arts of peace and progress, and not of aggression, and on those lines they desire to proceed unhindered and in quiet. If such danger is in store we must look for it from the adjoining Chinese, when they have cast off their inertia, and feel the strength of their numbers. Have we deserved well of the Japanese? Look at our recent attitude in Australia towards them, where they have been forbidden to put foot, and have been classed amongst the coloured races, as unworthy to mix with us, and as the "yellow peril." They feel such insults keenly, and properly so, too. Often, and with shame, have I heard their remarks on such treatment, *and as constantly have* rejoined that the *lowest and most ignorant* alone utter these sentiments, those who have no idea what true democracy is, but who follow its present debased imitation. But what astonished me more than all amidst this great nation was their educational system. Throughout the country State schools are dispersed, based largely on our own system; the standards are in use, and wherever practicable English is taught, so that very soon it will be difficult to find individuals who are unable to read at least English. In the bookshops may be found Japanese translations of the best writers in Latin, Greek, English, French, and German. Plato is side by side with Herbert Spencer. The Imperial University at Tokio is a marvel, and I spent portions of three or four days there. It compares well with any other University in the world, though but between 22 or 23 years old in its advanced state. It stands in about 250 acres of ground, which once formed the estate of the great Kaga Daimyo. The mansion and grounds have been, as far as possible, preserved in their entirety; the old quaint gardens, ponds, forest, and other amenities. Thus one can wander a distance in apparent privacy amidst natural beauty, until a cluster of handsome buildings in open space breaks the scene. This passed, the same condition again recurs — fresh beauty and other clusters. Thus are, in a measure, shut off from one another the various faculties or departments of law, medicine, engineering, mining, literature, etc. Special buildings are set apart for commerce, botany, zoology, geology, ethnology, bacteriology, seismology, and other ologies. The library is a magnificent building, with every facility for study, and numbers more than half a million volumes, amongst them being sets of our own Australasian scientific transactions. Yet the authors of these great deeds must not sully Australian soil! Oh, shame! You may notice that the only ology not in the list is theology, and this fact gives food for a curious speculation. The original Shinto religion, which was some years ago reinstated as what we may call the Established Church, was superseded 1,400 years ago by Buddhism, which was introduced from China by way of Korea. Since that time, with varying success, the two creeds have flourished side by side, and still have a strong hold on the people, though not so much on the more educated class. These, gathering the best from all nations with whom they come in contact, here draw a line, and many have adopted Agnoticism as their type of faith, or want of it. They are compounded not merely by the multiplicity of our sects, for these exist in as great numbers in Buddhism, but by the wide differences between Protestantism and Romanism, and by the still wider and more fundamental differences between these two and Unitarianism, so that their judgment is in a state of suspense. Quite recently there has been a movement towards a modified form of Christianity, perhaps, on the grounds that this, from a scientific point of view, is the most evolved form of creed with which the world is acquainted. How singular if the unbiassed and philosophic-minded Japanese should turn his attention to theological disquisition! Without reference to my notes, I think that there are about and about 100 professors or lecturers. These are housed in the best-equipped class-rooms, laboratories, and specialised museums it has been my lot to see, and the best work is turned out. Many of the professors, to wit, in seismology and bacteriology, are world leaders in their science and in other departments their names and labours are perfectly well known to scientific men. The average yearly fee paid by students is — and here again I am a little forgetful—about £10, and provision is made in suitable cases for a free course. The industries of pisciculture, sericulture, fruitgrowing, and forestry are all here scientifically taught, and when competent such students are sent to various parts of the Empire, deriving their own livelihood and diffusing their knowledge amongst the workers. The forestry department is a very large and important one, yearly increasing its labours, and I had the pleasure of spending an afternoon with some of its officials. It is housed in a huge building in Tokio, three miles from the University, and devoted to the purposes of an industrial museum. Here are exhigited specimens of every kind of work in which the Japanese engage—pottery, leather, cloth, iron, and wood work, every kind of fine art, and so on. An advantage is that prices are usually attached, so that visitors and purchasers can select, order, and pay for for whatever they desire. The department gives its order to the tradesman, and is itself the guarantee of excellent work. The forestry is represnted by specimens of every wood, to which is attached the fullest description of its botanical character, suitability, strain, cultivation, and other particulars. Further afield great work is done in planting trees, and great care taken in cutting down and replacing them. The vegetable murder, of which we are so constantly guilty, in burning off whole acres of forest, is forbidden, and if discovered severely punished. Such should be the case here, despite the sophism that it is good for the country, and opens the way for agriculture. As in Japan and in Germany, such work as the removal of forest timber should be entrusted to the forest ranger, *and beyond him should* be forbidden under penalty. Many of the Japanese forest trees are of great value, and should, I think, from the similarity of the climate, do well here. The Cryptomeria, one of the pines, may be especially mentioned. It is of immense size, handsome appearance, valuable and lasting as a house and bridge timber. The Lamas camphora is another very valuable tree, and I know that there are many others, but am unable at this moment to name them. The large bamboos—Bambusa—are used in Japan for most numerous purposes, and are as useful to them as is the New Zealand flax with us. This is reckoned a tropical or sub-tropical plant, but I have constantly seen it in the most flourishing condition under circumstances of raw, damp, and cold. Of course, it is one of the functions of a forestry department to collect and diffuse all the information it can regarding the growth and suitability of plants for various purposes, and it is this function that the Japanese officers are so competent and anxious to discharge. I promised them to do my best to bring about intercommunication wherever I went, and one that would redound to the mutual advantage of the parties. It would also have the further effect—no small one — of promoting friendship between this, one of England's colonies and themselves. Already they view the English with trust and liking for their knowledge, virtues, and justice, and here is a slight opportunity of extending this feeling, and of effacing recent utterances. I feel sure this learned society will, in accord with its traditions, give every aid to so important and scientific a matter, and I shall formally address the Agricultural Society here to the same effect.

He concluded by paying a high tribute to the excellent arrangements and management of the Tasmanian Museum and Art Gallery.

Mr. Rodway said he particularly appreciated Dr. Hocken's remarks on the forestry of Japan. Some of them had been trying for a long time to get a forestry department established in Tasmania, and they might get one before long. Any information such as that imparted by Dr. Hocken was therefore valuable to them, and the outcome of it might be that they would get valuable seeds from Japan.

At the request of Mr. Morton, Dr. Hocken agreed to forward from New Zealand particulars regarding the new forestry department in that colony, and the employment of prison labour in connection therewith. Mr. Morton explained that the reason he asked that question was that they had hopes of getting a forestry department in that colony, and the would help them very considerably if they could get prison labour to do the work.

### The Meteorological Service.

Mr. H. C. Kingsmill, M.A., asked that his paper dealing with the proposed scheme of the Federal Meteorological Service should be placed in the hands of the council to be discussed at a future meeting of the society.

The paper will be printed, and circulated for the information of members of the society.

Votes of thanks were passed to the members who had read and submittad papers.

# ABSTRACT OF PROCEEDINGS, AUGUST, 1904.

## ENCE OF H.I.M.S. LIGURIA'S OFFICERS.

monthly meeting of the Royal So-
of Tasmania was held in the So-
s rooms on Tuesday evening, August
e Lieutenant-Governor, Sir John
s, K.C.M.G., presiding. A party of
s of the Italian warship Liguria
resent, in response to an invitation.
Excellency, in opening the meet-
said:—Ladies and gentlemen,—As
embers are aware, the Royal Society
smania was the first scientific so-
of which her late Majesty, Queen
ria, became patron in these south-
ands. Its foundation was the work
at great Arctic explorer, Sir John
lin, and it is fitting, therefore, that
ers of this society, having become
that there is a distinguished
man, with his ship, in our port,
who has taken an active part in
exploration (having reached a
nearer the North Pole than even
n), should accord him a hearty wel-
to our shores. I therefore express,
ur behalf, and on behalf of the citi-
the pleasure we all feel at his visit.
he gratification it affords members
is society at seeing present, at this
ng, gentlemen who are officers of
ship of the Royal Navy of Italy. I
cordially welcome them on behalf
e inhabitants of this State. I
stand that the ordinary business of
ht will be curtailed somewhat, so
some Tasmanian views may be ex-
d to our distinguished visitors.
ause.)

Secretary (Mr. Alex. Morton) read
llowing communication from the
le-camp to the Duc d'Abruzzi, com-
er of H.I.M.S. Liguria:—His Royal
ess desires me to express his hearty
s to you, and to the members of the
Society of Tasmania, for your
invitation, and his regret at being
nted attending the meeting. Some
officers will be pleased to be pre-
and desire me to forward to you
kindest thanks for the invitation."

### New Member.

Rev. A. Brain, M.A. (St. George's),
alloted for, and unanimously elect-
member of the society.

### Federal Meteorology.

H. C. Kingsmill read a paper on
l meteorology. He said the mete-
ical department of the State had survived a good many changes. Now that another change was in contemplation, namely, its transfer to the Commonwealth, he thought it opportune to bring the subject before the society, with the object of considering how the interests of this State, and of meteorology in general, were likely to be affected by the change. What was there to be transferred? He answered by first giving a history of what had been done. Meteorological observations in Tasmania were begun by Sir John Franklin, in 1840, who sent home for instruments, and Captain Ross arrived in Hobart in August, 1840, in command of the Erebus, an observatory was built near Government House, and instruments for magnetic observations, a transit instrument for obtaining the time, clocks, and meteorological instruments were set up. Lieut. Ray was put in charge of the observatory, which was called "Rossbank." There he took observations for eight years, Sir John Franklin, himself, helping in the magnetic observations. When the Imperial Government handed affairs over to representative government in Tasmania, the meteorological work was carried on by its members. Among those were Mr. Henry, at Tamar Heads; Mr. Belstead, Westbury; Mr. M. E. Shoobridge, New Norfolk; Dr. Storey, Swansea; and Mr. F. Abbott, Hobart. They established climatological records, from which the permanent characteristics of the climate could be obtained, rendering valuable service. Subsequently, at conferences in Sydney and Melbourne, it resulted in an intercolonial scheme of meteorological observation being formed. With regard to Tasmania, it was unanimously resolved, on the motion of Dr. Hector, now Sir Jas. Hector, that the evidence before the conference shows the paramount importance of obtaining the co-operation of Tasmania in Australasian meteorology, and Mr. Ellery was deputed to secure the co-operation of Tasmania, "being regarded as of the utmost importance in advancing our knowledge of the movement and behaviour of storms, and of meteorology generally, in this part of the world." The Hon. W. Moore, in 1881, replied, stating that his Government was desirous of aiding the proposed interchange of daily weather telegrams with the Australian colonies, and would pass, free of charge, over the land lines of telegraph, all such messages. As the result, Commander Shortt, after receiving a course of instruction at the Melbourne Observatory, was appointed meteorological observer for Tasmania. The premises in the military barracks, Hobart, where the Observatory

is still located, were then made available for the use of the meteorological observer. Under Captain Shortt, the work of the Observatory took shape in its present form. The work was of a threefold character. There was, first, what may be described as a climatological survey, a description of the permanent features of the climate. The materials for this were obtained from local observers all over the island, as well as from the records of the instrumental readings taken at the Observatory. There has been no lack of good observers, persons willing to devote time and trouble to this work, provided that they are encouraged by knowing that their labours are not thrown away, but are turned to good account by being properly edited. All that they require is some guidance, and to be provided with the requisite materials and instruments. A great deal has been said from time to time about advertising Tasmania. There is no more effective advertisement to put into the hands of intending investors, or settlers in the country, than well-prepared climatological statistics, and it must be remembered that there are a great many varieties of climate in this little island. The second division of the work was the interchange of telegrams with the other States, and the preparation and publication of weather forecasts. It will be easily seen that this branch of the meteorological service is brought into close relationship with the Post and Telegraph Department, and that the transfer of one to the Commonwealth almost necessarily involves that of the other. The Minister responsible for a Federal Meteorological Department would naturally be the Postmaster-General of the Commonwealth. The third branch of work at the Observatory was the time service. Captain Shortt had charge of all this work until his death in 1892, when H. C. Kingsmill was appointed his successor. In order that the Government might have expert advice regarding the whole of the work, astronomical as well as meteorological, Mr. Kingsmill recommended that the Government should obtain a report on the astronomical work from an officer of the Royal Navy, chosen by the admiral commanding the Australian squadron, and that the services of Mr. Wragge be asked for from the Queensland Government, to make a report on the meteorological portion of the work. These recommendations were approved, and carried into effect. The astronomical report was made by Captain Purey-Cust, who spent a month at the Hobart Observatory, testing all the astronomical instruments, and checking the calculations of the Government meteorologist. These calculations principally referred to the determination of the meridian of the transit instrument, by means of observations of the Southern Pole star. This piece of work is done in Northern observatories by the North Pole star. It may be interesting to some of the members of this society to know that we have in the Southern Hemisphere a Pole Star, which is much nearer to the Pole than the celebrated North Star, although being of the sixth magnitude, it is not visible to the naked eye. Captain Cust's report was made a Parliamentary paper. It contains much valuable information respecting the conditions necessary for maintaining the time service with the degree of accuracy necessary for the guidance of shipping. The following is an extract from his letter to Sir Edward Braddon, Premier, June 14, 1894:—"The question of the correct time signals by the dropping of the ball is of extreme importance to the shipping world. . . At present, I am confident that the time is ascertained at the Observatory with the requisite accuracy, but with the numerous defects of the small transit instrument alluded to in my report, it requires constant and very careful management. . . I should like to suggest another important subject for shipping, namely, a daily reliable weather forecast. I believe that all the meteorologists in the colonies attach the greatest importance to the Tasmanian observations, Tasmania forming the extreme outpost to the southward of Australia." In May, 1895, Mr. Wragge obtained leave from the Queensland Government to visit Tasmania. He remained here for two months, and suggested many improvements in the organisation of the service, for which Parliament provided a portion of the necessary funds. An arrangement was also made for obtaining a daily weather forecast from Mr. Wragge for this State. He continued to send it with unfailing regularity for more than six years, at no cost whatever to Tasmania. When, through adverse circumstances, he was no longer able to continue sending, this portion of the work was undertaken, and is now carried on, by the local meteorologist. The advent of the Commonwealth has made a better organisation possible—such, for example, as exists in the United States of America, where there is a strong central weather bureau, which is in touch with the whole of that great country. The Americans are a practical people. They recognise that to be forewarned is to be forearmed, and in no country in the world is the expenditure on meteorology on such a liberal scale. For Australia, the cost of a central bureau need not exceed the cost of the efforts now made by each State separately, and it is to be hoped that the provision in the Commonwealth Constitution for bringing the State Observatories under its wing will not be allowed to remain a dead letter. (Applause.)

Discussion on the paper was postponed till the next meeting.

### Views of Tasmania.

Mr. J. W. Beattie then exhibited (mainly for the benefit of the Italian naval officers present) a magnificent lot of photographic slides of Tasmanian scenery, and which excited frequent applause on the part of all present. Mr. Nat Graham manipulated the lantern. The first picture was a portrait of Abel Tasman, who discovered Tasmania in 1642. and then his two ships, the Heemskirk and Zeehan, followed by beautiful views of Hobart, Brown's River, Huon-road Huon district, Hartz Mountains, the Peninsula, New Norfolk, and the Upper Derwent the Lakes, and the Lakes country. West Coast, East Coast, and Launceston, ending with pictures of the last group of the Tasmanian aboriginals, King Billy and Truganinni.

The Mayor moved a vote of thanks to Mr. Beattie, who was not only a remarkably skilled photographer, but an artist —(applause)—and who had done more than any other one man to advertise Tasmania. (Applause.) He included in the vote of thanks Mr. Kingsmill, who had read an able paper.

The following letter, under date July 28, 1904, from the secretary of the Royal College of Surgeons of England, was read: — "Dear Sir, — In reply to your letter of the 27th of May, I am desired by the president to inform you that the skull of William Lannee, to which you refer, is not in the possession of this college. Some correspondence upon the subject took place with Dr. Crowther; and from his letters it appears that he intended to present the skull to this college, but that, owing to an agitation which arose in Tasmania regarding the disposal of the remains of William Lannee, he was obliged to give up the skull, of which he had obtained possession. The president accordingly much regrets that he is unable to comply with the request of the trustees of the Tasmanian Museum. If the skull had been in the museum of the college, the president would gladly have sent a cast, as requested, and would have been most pleased to receive in return the casts of the other Tasmanian aboriginals mentioned in your letter. — (Signed) J. Forrest Cowell, Secretary. To Alex. Morton, Director of the Tasmanian Museum."

The opinion was expressed last evening that in all probability the skull never left Tasmania. It is to be hoped, therefore, that whoever has possession of it will hand it over to the Tasmanian Museum.

Eisenback Social Equality Theory. — Mr. Target and Mr. A. O. Green offered some remarks on the paper dealing with this subject, which was read some time ago by Mr. R. M. Johnston. Mr. R. M. Johnston briefly replied.

Federalisation of the Meteorological Department. — The next subject of discussion was Mr. H. C. Kingsmill's paper on this question, read at a previous meeting of the society. To facilitate discussion, Mr. Kingsmill briefly outlined the chief heads under which he had treated the subject in his paper. He was followed by Mr. Target, who pointed out the practical usefulness of meteorological observations. He concluded by moving that a deputation of the council of the society wait upon the hon. the Premier, and ask him to urge the Federal Government to take over the Meteorological Department, and, meantime, to take such steps as may be necessary to prevent its falling into disuse. Mr. A. O. Green also touched upon the practical importance of meteorology, and, further, pointed out that it would be very regrettable if any intermission in the meteorological records were allowed to occur. It was folly to reduce the department to a mere skeleton, just on the eve of handing it over to the Federal Government. He concluded by seconding the motion. The secretary, Mr. Alex. Morton, also spoke to the motion, and mentioned that captains of the large English steamers had frequently expressed the opinion that the time observations taken at Hobart were the most accurate with which they were acquainted. The Chairman supported the motion, which was carried uninimously.

The Secretary then read the following paper, prepared by Colonel W. V. Legge, R.A., entitled "Note on Stone Knives of the Tasmanian Aborigines—Found at Cullenwood Estate.": "These knives were found in a bank, or small tract of rising ground, about 100 yards from one of the broad, deep reaches of water which are characteristic of the Break o' Day River. The site was ploughed up somewhere about the year 1856, and since then has lain fallow. The specimens were discovered in digging post holes for a fence, and were from 8in. to 15in. beneath the surface. This depth may be accounted for on the supposition that they were turned under by the plough, and the depth being increased by the action of worms during the process of their workings, over a period of 50 years. The bank in question was, no doubt, a camping-ground of the East Coast tribes during the summer, and was used by them as a fishing station, where they captured their fish in the deep reach of the river, and procured the large fresh-water mussel so common on its banks. There are no flints about this bank; but around a smaller lagoon, half a mile distant, there are plenty of the same character as those found. Some years ago other specimens were found on a rising piece of ground, about half a mile to the south of this lagoon. The choice of these banks as camping-grounds may have been for safety purposes, so that a look-out could be maintained from them; but this theory is perhaps not very tenable, when we consider that there is supposed to have been but one tribe affecting this district. As winter resorts they would naturally have been chosen to avoid the severe frosts, which grip all low-lying flats on the Break o' Day plains with a band of iron. The sub-soil in the bank I write of consists of a remarkable brown clay, which has not been met with in any other part of the district, and a specimen of which is enclosed for the inspection of any geologist at the meeting."

Remarking on Colonel Legge's paper, Mr. R. M. Johnston stated that the Tasmanian natives derived a great part of their food from shell-fish, which in many cases accounted for the heaps of shells near the sea shore. The natives in all cases fed upon the kind of shell-fish which was most plentiful at any particular spot.

The secretary also read the following paper, which he had prepared, dealing with some Tasmanian aboriginal waddies, or throwing sticks:—

Since the last meeting I have had brought to me a very interesting ethnological specimen of a Tasmanian aboriginal waddy, or throwing stick. The Tasmanian aboriginal—the last aboriginal passing away in 1876—anything from an ethnological point relating to this now extinct race is always of more than ordinary interest. The only weapons used by the aborigines of Tasmania in fighting were the spear and the waddy. The waddy was a short piece of wood, about two feet long, seldom reaching to three feet, notched towards the grasp, and slightly rounded at the point, and was made of the tea-tree (leptosmermum) and of the young wood of (pittosporum bicolor). For the specimen now exhibited the Museum is indebted to Mr. H. Stannard, of the Ouse, who on presenting it, informed me that a party, on digging a ditch in the Brown Marsh, near Lake Echo, came across, about three feet from the surface, three or four of these waddies. My theory as to how these waddies got in that position is that at some time this marsh was one of our lakes, and swarming with wild water fowl. The natives out hunting, throwing these waddies at the wild fowl, would, owing to the heavy nature of the wood, find them sink, many being lost in this way. In my opinion many of these very interesting throwing sticks may be found by careful observers. The thanks of the members of the society are due to Mr. Stannard for the presentation of this interesting relic of a now extinct race, and his promise to forward the other specimens to the Museum.

The secretary also read a paper prepared by W. D. Campbell, A.K.C., L.S., L.F.G.S., etc., Assistant Geologist, West Australia, entitled "Notes on the aboriginal dancing boards of Western Australia."

The motion was passed amid applause, and the meeting terminated.

# ABSTRACT OF PROCEEDINGS, APRIL, 1905.

The Fellows of the Royal Society of Tasmania opened their session for 1905, being the 62nd, at their rooms, on Tuesday, April 11, 1905. His Excellency the Governor, Sir Gerald Strickland, K.C.M.G., President of the Society (accompanied by Lady Edeline Strickland, Miss Drummond, and suite), presided. There was an excellent attendance of members and friends. Her ladyship was presented with a handsome bouquet of flowers by the secretary (Mr. Alex. Morton), on behalf of the Council of the Society, upon her arrival.

### Apologies.

Apologies were received from Colonel W. V. Legge, R.A., Mr. R. M. Johnston, I.S.O., F.S.S., and Mr. Russell Young.

### Addresses of Welcome.

Mr. A. G. Webster, Chairman of the Council, addressing His Excellency, said:—Before they began the business of the evening, a pleasing duty devolved upon him. This was the first meeting of the Fellows of the Society since His Excellency had arrived, and had kindly consented to become their president, ex-officio. He, therefore, took the opportunity of offering His Excellency, on behalf of the Council and Fellows, a very cordial and hearty welcome. They all felt very much gratified that His Excellency had so readily acceded to the request to become their president, and to on that occasion encourage the members by delivering the opening address. His Excellency no doubt had already become acquainted with the history of the foundation of the Society by that distinguished man, Sir John Franklin, and, therefore, he (the speaker) need not take up time by dwelling on that subject, but content himself by saying he hoped that the 1905 session, so auspiciously began, would be productive of many valuable papers on the advancement of the State, and would add to the reputation already so widely spread which was enjoyed by the Society. He again bade His Excellency a very hearty welcome. (Warm applause.)

### Medical Section.

Hon. Dr. G. M. Butler, M.L.C., said that, in the absence of the President of the Medical Section of the Society (Dr. Wolfhagen), it devolved upon him to express to His Excellency, on behalf of that section, their most hearty welcome. Of necessity, the meetings of the Medical Section were held in committee; but he assured His Excellency that those meetings resulted in considerable benefit to the community at large, as well as to the members of this Society. It had been, as the chairman of the Council had just said, a matter for congratulation to the Society that they had had so many distinguished presidents, and now they were very gratified to have His Excellency at their head. (Applause.)

### New Members.

The following gentlemen were unanimously elected members of the Society:—Mr. Geo. Alex. Webster, B.A., M.R.C.S., Eng., M.B., Cantab; Mr. W. E. Masters, LL.B.; Mr. J. E. Smith, B.Sc.; Hon. Ellis Dean, M.L.C.; and Mr. Percy Ash.

## PRESIDENTIAL ADDRESS.

## "DUTIES OF LEISURE."

His Excellency the Governor delivered the following presidential address:—

Mr. Chairman, Members of the Council, and Fellows of the Royal Society,—The honour of addressing this Society as its president ex-officio is, at the same time, amongst the most pleasant and the most arduous of the duties devolving on the Governor of this State; it has been forcibly brought to my notice that the Royal Society of Tasmania is the senior Royal Society established in the Southern Hemisphere, and the vigour with which the point has been pressed has tempted me to examine if this be a mere coincidence, or the result of some relation of Cause and Effect.

One of the reasons that suggests itself at once is, that the exceptionally healthy climate of this beautiful island produces a high average of bodily and mental vigour, and that opportunities for industrial prosperity have made the struggle to live much easier in Tasmania than elsewhere in the Southern continent Where the struggle to live is less severe the fruits of realised labour become secure at an early stage of colonisation, and a leisured class arises which may devote its spare time and energy to divers pursuits other than the quest of riches. The geographical position of Tasmania, well ou of the tropics, has allowed our people to escape the fate of others in fertile subtropical lands on both sides of the world where life has become too easy, and the "dolce far niente" has dragged down communities full of promise to nothing better than a sybaritic existence. Acciden has also favoured Tasmania in adopting a lofty view of the opportunities of leisure —the presence here, at the dawn of our social life, of that eminent pioneer of modern scientific research, Sir John Frank lin, perhaps contributed more than any other cause to induce men in whom brains, leisure, and education were combined, not to keep their opportunities and talents hidden "under a bushel."

The example of Sir John Franklin has led Tasmanians to seek, by scientific investigation, how to extract from mother earth, from the sky, and from the waters around us, ever-increasing returns of comfort, security, and enjoyment for present and future generations. Insularity is also an important factor in the early utilisation of leisure for a good purpose; History, the best analyser of human nature, indicates that islanders have, as a rule, been intensely devoted to the land of their birth. As a consequence of being circumscribed, islanders are more ready to be resourceful, and therefore to investigate.

In the early history of the world's civilisation (as nowadays in the Pacific Islands, or in Central Africa) there was no leisure, no capital, no cultivation of science, because individuals in primitive communities have to work so hard to live from hand to mouth that they cannot pause to investigate the causes of things. Leisure is not always reproductive; in fact, it is usually an incentive to waste; nevertheless, it will appear on reflection that without leisure the cultivation of science is impossible, and it is well that the man devoted to science as well as the humblest worker should realise this fact. The man who works with his hands does not always grasp the assistance given to him by the man who works with his brains, and whose board and lodging is provided from previous accumulations of the results of manual labour. On the other hand, the man of science is inclined to be stoical, and the word "Leisure" on first reaching his ears often arouses his scorn rather than gratitude for that very leisure which is the immediate cause of his being at all possible. It is only within recent history that any other permanent investment besides land has been called into existence. Before this period landowners were the only class able to give some attention to science. The monks who lived in the great mediæval monasteries may be regarded as a community of land-owning bachelors; but the individual monks, who occasionally cultivated profane learning, ran risks of being misunderstood, if they were either too assiduous or too successful; in fact, the blunders of the Inquisition offered but poor encouragement to those who, for instance, proved that the Sun does not go round the world. If anyone in Tasmania still believes the world is flat, the Royal Society will, at the worst, hesitate to invite him to read a paper.

It is remarkable that Literature,
and Art were raised to a high st
by the leisured classes during centu
which natural sciences were neg
it might be expected that medicin
have commanded in early history
attention that could be concentra
it by wealth, and the anxiety to
life; nevertheless, medicine was no
ed scientifically, but by rule of
and the system of trial and erro
our own times. The discovery of
of printing did not do much for
sciences, until science had made p
commercially successful, and unt
books were brought within reach
many. A great factor in moder
gress has been the development
curacy in the mechanical arts. T
placed instruments of precision for
ing, testing, and measuring in the
of many investigators, and we sho
be slow to recognise that the m
monks were without these adva
and without easy access to books o
ence.

Modern clubs have been like
the monasteries of the Middle Ag
the parallel is not on "all fours,"
club men are not always bachelo
do they generally profess to devot
leisure to that scientific invest
which is the bond of union amo
members of these Royal Societies
mania and in other parts of the
To these free, modern associations
mitted, for future ages, the pursu
development of reproductive leis
the same way that the staving
ignorance and confusion was a f
for which the monasteries deserve
in the dark ages.

The "Royal Society of Lond
improving natural knowledge"
"association of men interested
advancement of mathematical and
cal culture." It is the oldest in
and was founded in 1660.

## The Royal Society of Tasmani

The Royal Society of Ta
was founded in 1843, and its
ing objects are "to investigat
physical character of the islan
to illustrate its natural history a
ductions." The official designation
ed in 1844 is "The Royal Society
Diemen's Land for Horticulture,
and the advancement of Science
hundred years ago a Society such
would have been impossible in Tas
Five hundred years ago (and five h
years is but a short period in the l
nation) it was hardly possible i
land. A thousand years ago, outsi
monasteries, men of leisure and
seldom knew how to read or wri

best of them, instead of cultivating science, devoted their energies to "the Crusades," the "Feudal Wars," and the "Chase." As civilisation progressed the building of castles and churches attracted the attention of the leisured classes. Later on the cultivation of the arts found an increasing number of patrons, but Poets, Painters, and Sculptors cannot enjoy the leisure necessary to pursue their art unless there pre-exists a class of men, combining weath and leisure, prepared to patronise them. The evolution of the power of leisure, traceable in the social history of England, is but a reproduction of the same development of human opportunities in the prosperous period of ancient Greece and Rome, not to mention the more ancient civilisation of Egypt, Assyria, India, and China. But the pursuit of pure science was rarely undertaken in ancient times by men of leisure. There is perhaps an exception in the well-known work of "Euclid," who appears to have been an Alexandrian Greek. His work bears internal evidence that it was compiled as a feat of intellectual gymnastics rather than for any practical purpose. Many serious thinkers in classical times were distracted from giving attention to natural sciences by a fashionable craving for metaphysical speculations and for philosophical discussions, which included abstract politics. Under these conditions the progress of the world was slow and intermittent, but under modern conditions, when leisure is so largely devoted to science, the progress of the world has become rapid and continuous. And as abstract politics have been mentioned, we may pause to reflect that by politics the Greeks meant the art of administering municipal affairs. Cities, with a fringe of country, were the political units of the age, and they were occasionally federated together. Politics, both theoretical and practical, have always offered an opening for the energy of the leisured classes, this, to my mind, is quite as praiseworthy as the pursuit of natural science, but not so productive of material prosperity for the masses of the people. Travel and exploration offered a splendid field for the energy of men of leisure, from the first journey of the Prodigal Son to the present day; now, however, it may be said that the discovery of the tantalising North and South Poles barely furnishes sufficient excitement for organised expeditions in this range of intellectual adventure. But there still remains an apparently inexhaustible field for the reproductive employment of leisure—notwithstanding all that has been heretofore discovered therein, in the objects which this Royal Society has in view, viz., the study of nature; this is before us as fresh as ever, its vastness does not fade with familiarity, the more we learn of nature the better we realise our comparative ignorance, and appreciate the number and the importance of new ways to useful knowledge that are still untrodden. Tasmania affords exceptional opportunities to the geologist, and I here venture to express pleasurable astonishment at the monumental work on the geology of Tasmania, compiled by Mr. Robert Mackenzie Johnston. When we realise that an officer of this State, in his important position, has found time — I can hardly call it leisure—to cultivate the science of geology with such original genius, and to place practical results on record for the benefit of others in an attractive form, we verily have before us an eloquent appeal to all men with brains and leisure to rise up and try to do likewise.

I may remind you that the work done in 1904 by this Society included the following papers: — "Insects and Diseases," by Dr. J. S. C. Elkington; "Observations regarding some Economic Aspects of the Eisenbach Social Equality Programme," by R. M. Johnston, I.S.O., F.S.S.; "Reservation of Crown Lands at Schouten and Freycinet Peninsula for the Preservation of Native Fauna and Flora," by Mr. J. F. Mather; "Notes on Japan," by Dr. Hocken; "The Establishment of a Federal Meteorological Department," by H. C. Kingsmill, M.A.; "Notes on Some Stone Knives of the Tasmanian Aboriginals," by Colonel Legge, R.A.; "Notes on the Discovery of Two Tasmanian Aboriginal Waddies at the Brown March," by Alex. Morton; "Eisenbach Social Equality Theory," by C. B. Target; "Notes on the Aboriginal Dancing Boards in Western Australia," by W. D. Campbell. One evening during the session was devoted to entertaining His Royal Highness Duc d' Abruzzi, Commander of H.I.M.S. Liguria, and officers. A large number of Tasmanian views were shown by Mr. J. W. Beattie. Two or three evenings were taken up in discussing Mr. R. M. Johnston's paper and Mr. H. C. Kingsmill's paper. I have been asked to suggest some line of inquiry for which Tasmania appears to offer exceptional opportunities.

As far as I can gather, no generally accepted theory has yet been formulated to explain mechanically how gold and other precious metals came to be where they are found, and as so many different metals are found in Tasmania, it may be possible to arrive inductively at their genesis, and if a more satisfactory theory than that these metals came from below as gas can be propounded, it may be of practical importance in following known indications of gold, or, so to speak, arguing down, from surface. The re-opening of abandoned mines will be encouraged, if confidence can be increased in the potentialities for deep workings. The systematical exploration of the crust of the earth also deserves better attention; boring by the heavy steam-driven diamond drill is most important, so much so that here and elsewhere it has received State assistance; but I earnestly trust that the use of the diamond drill is in its infancy, and that its scope can be greatly extended, e.g., by driving it electrically, or by diminishing the cost and weight of the machine, or by simplifying it so as to bring it more within the possibilities of handling it by unskilled labour.

In conclusion, I may be allowed to express satisfaction at the interest shown by the ladies of Tasmania in natural science. Although there are many other occupations generally requiring their attention, there is no reason why women endowed with scientific tastes should not be encouraged in devoting their leisure to research. In recent times a discoverer of radium has been a lady, and it may be mentioned that traces of this precious substance are reported in Australia. But for the fair daughters of Eve to devote their leisure to science is — and probably should be — an exception rather than the rule. In fact, the first instance recorded of misapplication of leisure is when Eve, wasted with an apple and a serpent, precious opportunities which will never recur. The ladies of Tasmania are, therefore, to be specially congratulated on the facilities nowadays offered by the Royal Society to employ their leisure otherwise. As to the apple, the men of Tasmania are protected from a repetition of that temptation by the phenomenal abundance of this beautiful fruit; in fact, Tasmania is out-rivalling Eve by offering apples of irresistible beauty, in and out of season, to the old Adams of the older world. The right to enjoy leisure involves corresponding duties; and active membership of this Royal Society is one of the duties of leisure which I venture to extol.

His Excellency was loudly applauded at the conclusion of his paper.

The Right Rev. Dr. Mercer, Bishop of Tasmania, said he could not well conceive a more appropriate bringing together of interesting matters than was contained in the excellent address they had just listened to. It implied a careful looking into their lives, and seeing whether they employed their leisure as they should do or not, and went on to make some excellent suggestions on the employment of leisure. *He remembered* reading of the leisure ob*tained by the Greek* race of old. No
doubt their marvellous works of A
Poetry generally were evidences of
sured class. But how was it broug
existence? It flourished, as ha
pointedly expressed, "on the du
of slavery." No doubt there mus
be a leisured class if there was
progress in Science, Art, and Lite
To make everybody perform a
amount of work of a manual or k
character every day would result in
gression rather than progression
doubt progress was largely depend
the existence of a leisured class,
was thankful to say that there we
evidences of a leisured class in Ta
—a leisured class of a right
—and that it was growing. (Ap
He was sure His Excellency woul
with him that there were two ki
leisured classes — those who spen
time in idleness, and the putting
of time, and a leisured class wh
ployed their time and talents in s
ture, and to the general progress
race. It was leisure of the latte
that they had in view that evenin
for one moment would he lose si
the fact that they must also have
for amusements, pure and simple,
work and no play makes Jack a dul
That applied to all of us, from c
up to dry-as-dust professors, who
times became so immersed in their
that when they met their fellow-
they had forgotten what they we
He happened one day to be in co
tion with Lord Kelvin, who aske
"What kind of logarithms do you
mentioning two very abstruse on
(the Bishop) did not use either, as
not a mathematician. But men w
came so severely immersed in their
would talk thus, just as some o
would say, "Have you seen such a
a paragraph in 'The Mercury' thi
ing?" This led him to say that he
the Royal Society would take up w
subjects of a more extended ch
and as to which His Excellency h
evening set a good example. (Ap
He (the speaker) was particularly
that the society should appeal to a
number of people than in the p
they confined themselves to purel
tific subjects, even though it i
geology and botany, two of the m
cinating of scientific subjects, th
pealed to too severe and narrow a
whereas if they now and then—he
not say always—had papers read
general character, such as would i
a larger circle of people, he co
help thinking that it would be
good of the society as well as for
the community. We in Tasmani
too small a community to support

as might otherwise be the case a society that limited itself to rather stiff subjects. Whilst he said that, however, he by no means meant that there was no place for scientific papers—most emphatically there was a place for them, and the publication of them in the records of the proceedings of the Society constituted a valuable State asset—but occasionally such subjects of more general interest, such as His Excellency had so ably handled that evening, were calculated to interest a larger circle of people, and to further the aims of the Society. (Applause.) He felt a keen interest in the Society and its welfare, and that it might do an increasingly large amount of good in the community was his sole object in making these suggestions. (Applause.) He now heartily and cordially moved that the thanks of that large and representative gathering be accorded to the President, His Excellency, for his thoughtful and stimulating presidential address. (Warm applause.)

Mr. Bernard Shaw seconded the motion, which was passed with acclamation.

His Excellency thanked all present for the kind way in which they had passed the resolution.

After the meeting, light refreshments were served in the large rooms of the Museum, the Art Gallery and other rooms being lighted. A very pleasant reunion of members and friends resulted.

# ABSTRACT OF PROCEEDINGS, MAY, 1905.

The monthly meeting of the Royal Society of Tasmania was held at the Museum on Tuesday, May 16. The president, His Excellency Sir Gerald Strickland, G.C.M.G., occupied the chair, and was accompanied by Lady Edeline Strickland and suite. There was a good attendance, including Right Reverend Dr. Mercer, Bishop of Tasmania, the Bishop of Laranda, Sir Adye Douglas, Sir Elliott Lewis, and several visitors, who were introduced.

## Election.

The following gentlemen were elected Fellows of the society:—Captain de Hoghton, R.N., Alderman George Kerr (Mayor of Hobart), Mr. W. S. Dawson, A.M.I.C.E. (Engineer-in-Chief Metropolitan Drainage Board), Dr. Kendall, Messrs. John Dowbiggan Foster, Henry Marcellus Nicholls, Lomas Smith, and L. H. Macleod.

## Notes on Tasmanian Minerals.

In the absence of the author, Mr. W. F. Petterd, Mr. A. Morton read his paper on "Tasmanian Minerals." In his introductory observations, Mr. Petterd wrote:—"The present contribution to the mineralogy of this State is of somewhat unusual interest, inasmuch as it describes for the first time an apparently new compound, which, although of no commercial value, is of some scientific interest. It is, in its way, a humble congener of the more imposing crocoicite, for the occurrence of which in such magnificent developments this island has obtained a great repute among mineralogists in all parts of the world, but, like it, is simply of scientific importance. The Lefroy meteorite, now mentioned for the first time, is, although of such remarkably small size, worthy of special note, and its detection in the prospector's dish adds another to the romantic discoveries of such objects from unknown space. The already long list of the different minerals recorded from time to time as being found in this State is still further augmented by the addition of no less than eighteen not heretofore published. Respecting these concise notes were given. Several of these, said the author, were of some scientific interest, and two or three would be of industrial importance if they could be discovered in sufficient quantity. Notes on additional localities for a few others which are already on record were given, with some remarks on the peculiar features presented by some few others. He had to record his obligation to Mr. J. D. Millen, A.S.T.C., M.S.C.I., London, metallurgical chemist, *for undertaking the* analysis of Bellite and *Hercynite. The following* is the list of minerals of which particulars were given:—Barrandite, Bellite, Cloanthite, Enagite, Echerite, Genthite, Gibbsite, Heliophyllite, Hercynite, Hydromanganocalcite, Lefroy meteorite, Leucophanite, Manganite, Minium, Niccolite, Pilotite, Plinthite, Pimelite, Proustite, Pyrargyrite, Pyrostilpinite, Quartz, Scorodite, Siciliophite, Smertite, Steargillite, Stephanite, Stibiconite, Touramline, and Wurtzite.

His Excellency said he felt that it was one of the charms and enjoyments in being present to listen to the arguments and the thrusts and parries of discussion. Even that paper, short as it was, might give scope to some remarks. He was impressed himself with the principle which drew to their attention the presence of rare or unknown minerals in Tasmania.

Mr. Morton eulogised the work of Mr. Petterd in elaborating a list of the minerals found in Tasmania, and said his work was recognised not only in Australasia, but throughout the world.

## Postponed.

The reading of a paper by Mr. J. R. McClymont, M.A., on "Birds Observed by Crozet on his voyage" was postponed until next meeting.

## Paper by Mr. R. M. Johnston, I.S.O., F.S.S.

Mr. R. M. Johnston read a paper on "A Proposed Psychometer Index Designed as an aid to the Better Determination of Common Fungoid Illusions, and of the Comparative Value of Mental Concepts."

The author said he was aware that his paper would probably give rise to great differences of opinion, and perhaps very virulent opposition to the view he had taken up. He, however, had come forward rather to show how to convey, with a simple diagram, an eye-picture which disclosed in a natural way the order of the diminishing value of judgment which was dependent upon the nature and condition of the person's stage of observation. Closely condensed, Mr. Johnston's argument was that the order and equilibrium of the mind are intimately connected with the vigour, fulness, and health of the organs of sense. Many persons, he said, committed mental suicide for the sensual delight of a useless momentary wonder. The insane, by disease, were forced to live always within a world of wonders such as those sought after, at times, by the ignorant. He had prepared a classified "Psychometer Index"

to some might be useful in show-
he treacherous nature of the ap-
t value of judgments based upon ob-
tions of the crippled senses. He
d by this classified "psychometer
" that we may only hope for or-
concepts, free from illusion, within
w limits. Beyond this limit orderly
ption diminished or lessened in
. It would seem, he said, that pas-
distorts or gains ascendency over
judgment in proportion to the degree
e diminishing power of the senses,
, approaching the zero of the under-
ing, the state coincides exactly with
ity. The insane state consisted of
inds of unreasoning beliefs; but,
e sane concepts, they were marked
real pitiful intensity of conviction
ich the sane mind could never hope
er wish for within the logical order
e higher states of consciousness.
r be a dull, pulsating mass of pro-
sm than to be adrift upon a stormy
of disordered concepts, when the
r and helm of the senses had been
red nugatory, or had been for ever
oyed. Let them beware, therefore,
e intensity of a conviction which
n that way, related. Notwithstanding
had been stated in opposition to
ons of a fungoid character, he was
rom being convinced that all illu-
, as such, were harmful. He was
ed to think that a beneficial pur-
was served by many of them, especi-
of such as were born of the extraor-
y strength of love, affection, sym-
, and the higher poetic fancy. The
er, for example, saw favourable
ties in her child which no other eye
ded, and, frequently, had no real ex-
e. Who, therefore, would wholly
h the mist of the affections? He,
ne, would not if he could. A large
of illusions might fairly be classed
r this order. All illusion, or partial
on, which for the moment may be
sary to our comfort and well-being,
ually, and not liable to introduce
remotely great evil consequences,
ould be sorry to see wholly dispelled.
id not regard or class such as "fun-
illusions." Illusions which were
ful were regarded as "fungoid" in
stimation. They had seen that it
t be possible to reach the zero of
ble concepts, and, indeed, of all
iousness, in two widely different di-
ons. On the one hand, it might be
ally approached through varying
s of fictitious wonder, imagination,
n-illusion, insanity, and by the de-
tion of one after the other of those
erful organs of sense, which, though
of feeble range, are yet in the highest sense, God-given, Heaven-born. On the other hand, by humble mien and fearless confidence, they might, through all the channels of widening sense, advance to still greater heights, wider horizons, which might be ordained that they should yet conquer. There were still almost infinite circles within the legitimate domain of natural science, but beyond the limits of our present knowledge and range of powers. Yet, even now, from a thousand heights of sense, we could perceive that, however we might increase in subjective knowledge — i.e., natural knowledge — the objective mystery which surrounded us, which we feel we can never penetrate, was but increased by every advancing step in natural knowledge. We feel that though new chords should continue to be struck on "the harp of a thousand strings," the "everlasting arm" which was the cause of their harmonious vibrations could, itself, never be revealed to us save through that veil of the sensible in which "we live, move, and have our being." Do not, therefore, said Mr. Johnston, foolishly tremble under the illusion that all mystery shall be dissipated, or that the veil may be pierced, if we but open wider our dim eyes, or stretch out a little further our feeble hands. Their limits — not determined by us — not written on tables of stone, and soon enough reached — were the truest and best guides. The created mysteries of distorted imagination and the crippled senses were but a poor "mess of pottage" as compared with our glorious birthright of orderly natural knowledge and feeling. If still — like wilful children — we will have a deeper mystery, let us, with the fullest possible equipment, attempt to penetrate from every portal of sense the cause of which they are themselves wondrous symbols. The effort to do so will convey an impression which cannot be effaced. Thereafter the appalled and humbled mind will gratefully shrink back within its own protecting luminous mist of the higher poetic ideal, and, with the chastened submission of a child cry—"It is enough." "Thy will be done." "Nor swords of angels could reveal what they conceal."

Observations on the paper were offered by Bishop Mercer, the Bishop of Laranda, Dr. Gerard Smith, Professor Ritz, Mr. Russell Young, and finally by His Excellency.

On the motion of Mr. A. G. Webster, a vote of thanks was accorded His Excellency for presiding.

# ABSTRACT OF PROCEEDINGS, JUNE, 1905.

## AN INTERESTING EVENING.

At the monthly meeting of the Royal Society on Tuesday evening, His Excellency Sir Gerald Strickland, president of the society, occupied the chair, supported by members of the council, and there was a fairly good attendance, especially considering the wet and wintry state of the weather.

### New Members.

Messrs. St. Michael M. Podmore, F.R.G.S., F.Z.S., M.A. (Camb.), and W. Heyn were balloted for and elected corresponding members, and Mr. C. W. Grant was unanimously elected a Fellow of the Society.

### Birds of the Pacific.

The secretary (Mr. Alex. Morton) read a paper prepared by Mr. J. R. McClymont, M.A., entitled "Notes on certain birds met with by Crozet, one of the very early navigators." The voyage of Marion du Fresne, with whom Crozet sailed as second in command of the Mascarin, was undertaken in orde rto restore to his native island a Tahitian, whom De Bougainville had taken to France, and also in order to discover on the way a continent or islands in the Southern Ocean from which useful products might be obtained. Crozet, who writes in a simple and unassuming manner, expressly disclaims a scientific knowledge of natural history. But his observations have an interest and importance of their own from an historical standpoint, because they are those of one of the discoverers of Marion and the Crozet Islands, and of one of the first Europeans to land in New Zealand and in Tasmania. The narrative of Crozet is contained in a volume which is somewhat scarce, but it has lately appeared in an English translation. Crozet's observations on birds begin on January 8, 1772—twelve days after he had sailed from the roadstead at the Cape of Good Hope. Terns are the first birds noted, and terns and gulls (Poules mauves) were seen frequently from the 8th until the 13th day of January. The ships were then near Marion Island, and the discoverers observed auks and divers for the first time. On January 24, Crozet landed on one of the islands of the group, which is now known as the Crozet Islands, naming it Ile de la Prise de Possession. The sea-birds, which were nesting on the island, continued to sit on their eggs or to feed their young undeterred by the approach of the explorers. Amongst these birds, Crozet enumerate ducks, divers, Cape fulmars, cormorants, and "envergures." The auks, or "pingoins," to use Crozet's name, were doubtless penguins, which
are generally called "manchots
though the name "pengouin mar
also occurs. The divers, or plo
are supposed to have been divin
rels; the Cape fulmar is call
damier." "Envergure" does not
in dictionaries as the name of a
signifies "length of ship's
"breadth of sail," and, by exten
meaning, "expanse of wings." It
haps, the trivial name of an al
analagous to the Portuguese nam
tennal." If we examine these d
the light of modern exploration
that at least four penguins hav
obtained in the region of the oce
tiguous to the Crozet Islands, or
islands. These are Aptenodytes
gonica, Pygoscelis papua, Catar
chrysocome, and C. chrysolophus,
only one of these—C. chrysoloph
the lecturer find that the eggs ha
obtained on Crozet Island. The
petrel, Pelecanoides exsul, is kn
frequent the Crozet Islands, but
appear to be undescribed. The Ca
mar (Daption capensis) is widely
buted over the Southern Ocea
there are few records of its egg
found, and these few relate to
len Island. The white winged (Di
chionoptera) is the albatross,
makes these islands its nesting
Cormorants cannot with certainty
cluded amongst the avian inhabit
the Crozet Islands. Their nearest
place of resort is Kerguelen Isla
tween 1,390 and 1,400 miles
where Phalacrocorax verrucosus
dent, and where its eggs have b
tained. Finally, a bird which w
taken for a white pigeon was p
a sheath-bill (Chionarchus croze
From the presence of this bird,
naively augured that a country
ing seeds adapted for the susten
the pigeons could not be far dista
duration of Crozet's sojourn in N
land was about four months –
March 24 to July 14, 1772. He
us with a goodly array of the n
birds which he saw in that count
to seek equivalents for the wh
the wagtails, the starlings, and
the ousels and thrushes of his n
would be unprofitable labour.
ception may be made in respect
black thrush with white tufts by
the tui (Prosthemadura novæ Zea
is evidently meant. Crozet divid
primitive way the New Zealan
which he saw into birds of the fo
the swamps, of the open country,
the coast. In the forests were
pigeons as large as chickens, in
blue, with metallic reflections.
scription, though scant, is su
There is only one pigeon in New Z
and no remarkably pigeon-like b

n, so that we cannot err in be-
Hemiphaga novæ Zealandiæ to
pigeon "ramier" of Crozet. The
emiphaga is represented in Cele-
the Phillipine islands as well as
Zealand. In the beginning of
Crozet had become acquainted
Tasmanian parrakeet with a
r light-coloured) bill, the plum-
hich resembled that of an "Ama-
rrot. The common Amazone par-
rysotis amazonica) is green, and
orange-red speculum and a blue
l. It was represented by
nton, and may be the parrot to
rozet refers in the expression,
uet des Amazones." There is no
ian psittacian, which greatly re-
it; perhaps the blue-banded
arrakeet (Neophema venusta) re-
it the most. In New Zealand
er parrots were observed—a very
rrot, in colour black (or dusky),
ed with red and blue, and a
ory, the plumage of which re-
that of the lories of the Island
Red and blue enter into the
of the red only of large New
parrots. The red (Nester nota-
iowever, is restricted at the pre-
y to Stewart's Island and the
sland, so that we must suppose
hat a change has taken place in
tribution of this parrot since the
Crozet's visit to New Zealand,
Crozet has erred in the descrip-
it. In the latter case the bird
d to be described is probably the
lestor meridionalis). The smaller
ealand Psittaci are not lories in
eral acceptation of that name,
atycercinæ of the genus Cyanor-
s, a widely-distributed genus
ing some fourteen species, of
New Zealand has at least four.
t known is C. novæ Zealandiæ, a
arrakeet with a crimson sinciput.
open country were the smaller
e birds already mentioned, to
Crozet gives the names of Euro-
irds with which he was familiar.
was also a quail similar to the
n France, but larger, Coturnix
ealandiæ, which is now extinct.
swamps wild duck and teal were
nt, and a blue hen, similar to the
ens in Madagascar, India, and
This blue hen is evidently the
hen (Porhyio melanotus), which
s Tasmania and the eastern part
tralia as well as New Zealand.
her blue hens to which Crozet
it are probably porphyrio, which
d in Madagascar, poliocephalus
dian, and edwardsi, an Indo-Chin-
ies. On the seashore were curlew,
ants, and black and white egrets.
rlew may have been of the species
ius cyanopus, which visit New
l in summer, and which remain
ll numbers through the winter. A pied egret is suggested by the phrase, "aigrettes blanches et noires." But there is no pied egret in New Zealand, and we are forced to suppose that the bird in question is the white-headed stilt (Himantopus picatus), which has been found nesting in New Zealand. A black bird with bright red bill, and feet of the size of an oyster-catcher, also frequented the beaches. Evidently this was the sooty oyster-catcher (Hæmatopus unicolour), which is resident. Of birds which frequent the open sea as well as the coast, Crozet enumerates grey terns, white terns, "envergures," and gannets, with white bodies and dark wings. These birds, he adds, were of the kind called "Manche de velours" by sailors. The "Manche de velours" is the Cape gannet (Dysporus capensis), which has black primaries, as also has S. serrator of Australian and New Zealand seas. S. cyanops has both primaries and secondaries, dark in colour, and might, with greater propriety, be called a black-winged bird than S. serrator. It is, however, not common in extra tropical areas.

### Species and Hybridisation.

Mr. St. Michael M. Podmore, M.A., F.R.G.S., etc., a visitor from England, read a paper on hybridisation in relation to animals and the definition of species, narrating the result of his own experiments and investigations. In Darwin's "Origin of Species" are these words:—"The only distinction between species and well-marked varieties is, that the latter are known or believed to be connected at the present day by intermediate gradations, whereas species were formerly thus connected." Again:—"The power of remaining for a long time constant I look at as the essence of species." In his subsequent letter to Osa Gray, Darwin wrote:—"I speculated whether a species very liable to repeated and to great changes of conditions might not assume a fluctuating condition, ready to be adapted to either conditions." Mr. Phillips, the palœontologist, arrived at the conclusion that a species represent "any form which has ever had a specific name." This definition, though vague, the lecturer claimed as worthy of acceptance by students, though the words of Sir Wm. Dyer are, perhaps, more explanatory:—"Species is a designation for a totality of individuals differing from all others by marks or characters, which experience shows to be reasonably constituted and trustworthy." Personally, he (the lecturer) was of opinion that Darwin never did believe in the possibility of defining species, and would have preferred the term "fixed variety," had Darwin not been confronted with the difficulty that varieties of a species are invariably prolific inter se, while the offspring of a crossed species, or hybrid, had invariably proved, in his time, to be barren. It was not his (the lecturer's) intention to enter into controversy on this point, but desired to place information before the meeting of a unique character from his own experiments, observations, and study, in the hope that these investigations and experiments might be continued, thus enlightening the world further on the limits or development of the creation system. Darwin did not believe in a "special creation" with defined and absolutely fixed species, nor can we, if, by their hybridisation, fertile offspring are produced. Every describer of species has made continuity and transition in characters the test of variety, and discontinuity the test of a separate species. Darwin differed sharply from Huxley on the one hand, and Wallace on the other, as to the significance and history of sterility between species, and his conviction appears to have been that the same cause which induces varieties in a domesticated species removes the barrier of natural sterility between two different species, when crossed. He seemed to attribute a mysterious unknown power in domestication, and on these lines he (the lecturer) had carried through another interestingly difficult experiment in hybridisation. Whatever may have been the origin of belief and its present acceptance, the facts of recent experiments prove that species, recognised as fixed, have inter-bred, and healthy, fertile offspring have, in some cases, been the result. Young of wood pigeon hybrids, formerly believed to be impossible of production, he (Mr. Podmore) had had the honour of presenting, for the first time in the history of zoology, to the scientific world. These prolific hybrids are now living in the western aviary of the London Zoological Gardens. During the past 15 years he had reclaimed domesticated and hybridised British wild doves. He then described his method of breeding hybrids. As to pigeons, "it is necessary to procure young wood pigeons before they are fledged. A bird reared from the nest at eight or nine days old will remain tame for life, if proper care and kindness are used. Birds reared by placing wood pigeons' eggs under domestic pigeons are always useless, as they become so wild that, in my case, I have been obliged to destroy them. The same is the result when birds are taken after the feathers have partially developed. They become fairly tame during the process of daily feeding and handling, but as soon as they become independent they revert to their original wild type. To rear young birds a knowledge of pigeon ailments and requirements is necessary. The appearance of the plumage, clearness of the eye, and general activity of the wings and legs, are good guides. They not only *require freshly*-prepared food daily, but, in addition to grain, lettuce, chopped meat, Hyde's grit, sulphur, castor-oil, linseed, and chalk, as experience dictates. When the young can fly they should be trained to the sound of the voice. This can easily be done by uttering some familiar words or whistling during feeding time. I have also made use of certain movements of my hand to summon my birds, at first simply snapping the fingers or twisting the hand round in a circle. I have a male hybrid, about six years old, that still remembers and obeys such signs. As to feeding parents and young, plenty of room is necessary for breeding purposes, and each pair must be confined in a separate aviary. The age of the domestic male should be in excess of the female. Hemp seed, dari, and fresh lettuce should be given during mating time, but after incubation has commenced hemp seed should be omitted. When the young are hatched fresh lettuce is most important, together with sound grain, such as wheat and dari (no Indian corn). The aviary must be kept clean, grit sprinkled daily upon the ground, and clean water regularly supplied. If the nest-box has a foundation of soft, elastic material, the birds will probably be reared. In my own case I put paper clippings to a depth of half an inch, and covered the top with straw and fine twigs. In a wild state the nest is composed of materials that give the weight and movements of the young. I found nearly all the young birds that have died suffered from internal complaints, brought about by the heavy pressure of their bodies upon the hard, unresisting surface of the nest-box. I think, however, the wisest course would be to remove the young from the parents after the eighth day, and bring them up by hand. In selecting a mate, I commenced with a pure-bred white Dragoon hen mated to a black Dragoon cock that had a few white feathers at the side of the neck. After twelve months, one bird was reared with a decided ring, like a dove. This proved to be a male. I now bred with a large blue Carrier, whose plumage contained the greyish-blue feathers, and from his cross I procured the male parent of dove hybrids. During the year 1899 I became decidedly disheartened, having lost, from different pairs, no fewer than forty young birds, from causes what appeared to me at that time unaccountable. On August 2 I wrote to the press:—"Eleven days seem about the extent of life permitted to the young of this curious cross - breeding. The hen generally dies on the fifth day, and the cock on the eleventh." It happened that just at the time when I was about to give up my experiment, success came. In September, 1899, I reared a ring dove hybrid that has proved one of the healthiest and hardiest of the pigeon family. He has twice crossed the Atlantic, and survived the extremes of heat and cold during exhibition. This bird is now on view at the London Zoological Gardens. This ring-dove hybrid was mated to a blue homer when six months old, but it was not until 1902 that any eggs were fertile. During last year I bred three handsome birds from this cross—one proved to be a hen. The note of the ring-dove hybrids' young is unlike that of any known species, though its gestures when paying court to its mate resemble the British wild dove. Before leaving England the female bird had already laid her second clutch of eggs. In 1898 I reared a healthy hybrid from the wild male stock dove and the wild wood pigeon. In hybridising the African turtle, I mated the female wild bird to a crossbred almond tumbler. Their offspring were fertile inter se. The collared dove reared healthy offspring with the magpie pigeon, and the blue rock produced fertile young with the wild stock dove hen.

His Excellency said Mr. Podmore had laid very carefully before them, in a scientific — and, he would like to add, modest—manner the results of very important experiments that he had carried out with the view of proving the ultimate tendency of the Darwinian theory. Mr. Podmore had also given them an insight into the very broad problems that underlaid the consequences of those experiments if they were proved, and while frankly accepting Mr. Podmore's purely scientific attack upon what he aptly designated the "creative system," he thought there were some considerations which should be laid before the Society in defence of that creative system. Mr. Podmore had pointed out that if there was no such a thing as species, and if every type was a vague transition from one variety to another, then, of course, the descent was very simple between the vague cell of protoplasm and the modern development of the genus homo. Mr. Podmore, however, himself gave them strong openings against his own researches, by indicating doubts whether the experiments he himself had carried out were, in fact, between species, or merely between varieties. If the experiments Mr. Podmore had carried out were merely as between varieties, his theory fell to the ground by the hypothesis upon which it was built. It was well known that among the lower forms of life crosses had been obtained, not merely between what were recognised as species, but even between different genera, especially as between the winged insects and the lower forms of life to be found in water. So there was nothing very new in the class of facts proved by Mr. Podmore's experiments, excepting that he had worked a stage higher, above the region of botany and that of the lower animals, i.e., among birds. There, however he was still far below the region of crosses among the higher animals. Where previous crosses had been obtained, they had ceased to be fertile after a few generations. Mr. Podmore was yet unable to tell them the result of his varieties after a certain number of generations. In conclusion, it seemed to him (the speaker that all these experiments which Mr. Podmore had so ably, scientifically, and disinterestedly carried out, analysed in the manner in which men of eminent genius and scientific research, like Darwin, had already speculated for hundreds and thousands of years—still left us just exactly where we were 2,000 years ago. They had all failed, notwithstanding all researches so far, to put even the thin end of the wedge into the creative system as we had been brought up to believe it. He ventured nevertheless to thank Mr. Podmore for the additional proofs he had offered, as they showed, if anything, the weakness of the attack upon the strength of an impregnable fortress.

Mr. Podmore disclaimed any intention of attacking the creative system, and thought he had clearly explained that; he must have been misunderstood. His work tended in no way to upset the creative system; but everybody who had studied zoology understood the muddle and confusion of classifications, and what was attempted was to try and prove what was especially fixed variety, so that there might be uniformity throughout the scientific world, and muddle cease. The great thing was to try to find truths recognising that, in doing so, there was a power above us Who would reward us with new light. (Applause.)

Mr. R. M. Johnston and Mr. A. O Green warmly commended Mr. Podmore's paper and his work.

### Army Signalling.

Major F. T. Hayter, R.A.A., D.A.A.G. gave an exceedingly interesting and instructive address on army signalling with the aid of diagrams explanatory of various methods of army organisation and a fine lot of army apparatus belonging to the Defence Department, and of the very latest make and efficiency. He was assisted in his demonstrations by Master Gunner O'Rourke, who is accounted an exceedingly smart and efficient officer at this kind of work (having been trained with the Royal Field Artillery) Major Hayter explained how the intelligence and other army departments are worked. Without accurate and speedy circulation of orders and information in an army during war there must be disaster. For instance, the Japanese in their advance on Mukden had half a million of men with a front extending about 100 miles. The whole of those 500,000 men must have operated on a concerted plan; every section of that army had to be at the right place at the right time, and then do the right thing, to which end a system of telegraphing and army signalling must have been brought into requisition with great efficiency. The telegraph stood head and shoulders above everything where it could be used. It was largely called into requisition along the lines of communication. But telegraphs and telephones needed to be guarded, which took a lot of men. Wireless telegraphy could not, at present, be used by the army in the field, because it required too much apparatus, and was, therefore, cumbersome. The Morse lettering system was adopted in all army signalling, excepting in the semaphore system. He then demonstrated the Morse flag signalling, in which smaller flags are used for short distances, and larger ones for longer distances. There are also two colours used, white for use on a dark ground, and blue for a light ground. The message is spelled out by a system of waving the flag (long and short waves and combinations) on the Morse alphabet plan. Diagrams were shown of the Morse dot and dash lettering, short waves of the flag representing dots, and long sweeping waves, dashes. In tolerably clear weather signalling can be carried on in this way over a distance of seven miles with the aid of telescopes. The semaphore flag signalling, which Hobart people daily observed in use between the warships and the shore during the stay of the Australian squadron in the harbour. This system differs from the Morse one, in that each letter has a separate and distinct symbol by the use of two flags at once. It is a simpler, therefore more easily learnt, and a more rapid means of signalling messages; but it is only practical over short distances up to 800 to 1,000 yards, and it is very readily forgotten, the angles having to be so accurate. The heliograph system was next explained, and the instrument exhibited, its working being made clear and extremely interesting. This signalling arrangement is carried on by mirrors on a tripod, reflecting the light of the sun in a series of flashes, on the Morse alphabet principle. By these means messages can be sent over distances up to 70 miles, provided, at the latter range, the apparatus can be mounted high enough to compensate for the "dip" in the earth's circumference. The atmosphere is a little bit dull for this instrument in Tasmania. In India it may be worked with much better results. The signalling lamp, for night use, was shown at work on the Morse flashes principle, and is good for seven miles, according to the state of the atmosphere. This lamp is a recent invention of a very smart British army officer named Begbie. Another more powerful lamp, but not so portable, Major Hayter explained, was the limelight lamp. It required more apparatus, but it was very powerful. With this it is possible to signal over 15 miles in the night time.

A signalling party belonging to Capt. A. C. Parker's Engineer Corps gave a demonstration in the working of a terminal signalling station in the field.

His Excellency expressed his pleasure to notice that the scientific side of army training was being so well developed among the Commonwealth forces.

Capt. Dormer, A.D.C., said Major Hayter and the Master Gunner had given them very interesting and correct demonstrations in army signalling. Such signalling had now become of immense importance with armies operating on such a wide front. In the South African war it proved extremely useful. (Applause.)

The meeting then terminated with votes of thanks to the readers of papers and to Major Hayter and his party.

# ABSTRACT OF PROCEEDINGS, JULY, 1905.

The monthly meeting of the Royal Society was held at the Museum on Monday evening, July 10, the President, His Excellency Sir Gerald Strickland, K.C.M.G., presiding. Among those present were.—Bishop Mercer, Mr. A. G. Webster (chairman of the council), Sir Elliott Lewis, Hon. G. H. Butler, Sir Adye Douglas, Messrs. G. E. Moore, M.H.A., Russell Young, and several lady and gentleman members of the society.

Mr. Morton, secretary, apologised for the absence of Mr. R. M. Johnston, I.S.O.

His Excellency said he had been invited —as president—to represent the feelings of the Royal Society in offering very hearty congratulations to Mr. Bernard Shaw on the occasion of His Majesty the King having conferred on him the recognition of his long services by making him a member of the Imperial Service Order. In looking at the report of the honours conferred on the whole of Australia and Tasmania on the last occasion, it had been a matter of satisfaction to him to observe that Tasmania had not been forgotten, but that she had received comparatively a fair share. Mr. Bernard Shaw's services were remarkable as having commenced at the age of 17, so long ago as 1853, in which year he entered the Public Service of Tasmania as clerk in the office of the police magistrate, Swansea. The office was abolished by the introduction of local municipal government in 1860. He re-entered the service in 1866 as acting police magistrate, Devonport. He held successively the offices of Clerk Assistant, House of Assembly, police magistrate at George Town, Commissioner for Mines, Secretary for Mines, Commissioner of Goldfields, Commissioner of Police and Sheriff, Police Magistrate and Commissioner Court of Requests, trustee of the Tasmanian Museum and Botanical Gardens, and a member of the Council of the Royal Society of Tasmania, also Commissioner of Fisheries of Tasmania. Mr. Shaw retired from the service on August 28, 1904, and was granted a pension by special Act of Parliament.

Mr. Bernard Shaw, I.S.O., thanked His Excellency for the kindly way in which he had referred to his services. It was very gratifying to receive such a token of appreciation and goodwill. (Applause.)

His Excellency said that two important papers had been prepared for their consideration that evening, each of which contained ample matter for at least two sittings and for prolonged discussion. He thought the best way would be to have the two papers read first, and leave the discussion of the paper on coal to a future meeting. Dr. Elkington's paper might, perhaps, be discussed that evening.

*Mr. K. L. Murray, C.E., then read* a somewhat technical paper on "Coal and a Coal Mine," which was illustrated by specimens from the Sandfly colliery and other coal mines, both in and outside of Tasmania. The most valuable constituent of coal was fixed carbon, of which the Sandfly colliery product contained satisfactory amount. It was generally acknowledged that semi-bituminous coals were the best. The two leading instances of this class of coal in the south were the Tasmanian Sandfly and the Victorian Jumbunna. The latter was recognised in Melbourne as the best obtainable. It sold at from 4s. to 6s. higher than any other coal, including the Newcastle coal. The Sandfly coal was similar in character to the Jumbunna coal, and even the fossils were similar. The lecturer drew a comparison between bituminous and semi-bituminous coal, and showed that the use of the latter would to a large extent do away with the smoke nuisance. The speaker then described the way in which coal was formed hunderds of millions of years ago, when the earth was in a far different condition to what it was now, pointing out that nature never was in a hurry, and that for millions of years no use had been found for these coal measures, till at last a creature was formed who discovered that coal would burn. Fossils were found in these measures which belonged to the mesozoic period from which they could gather some idea at what a distant period some of the coal had been formed. The difference in the density of coal was owing in a great measure to the different periods at which it was formed, some being very much earlier than others. Anthracite coal, for instance, was much denser than any other coal, of which he produced samples that evening. It was the lowest in the Sandfly colliery, and was the oldest formed. In conclusion, he said that it had been proved that a field of very great importance and value existed over a wide area and under the same conditions near Hobart consisting of anthracite and semi-bituminous coal. (Applause.)

His Excellency regretted that Mr. Murray could not be present that day month when his paper would be discussed, but it was so important that it might command the attention of the society for a whole evening. He now called upon Dr. Elkington to read his paper.

Dr. Elkington (Chief Medical Officer) then read an exhaustive paper on "Some Social and Economic Aspects of Public Health Work." This was generally regarded as the youngest daughter of medical science, but it had flourished among the ancient Jews. The Mosaic system of sanitary law impressed upon every individual the fact that he was h brother's sanitary keeper, it forced him to conform to sanitary rules, and afforded an example of public health legislation which in many important respects was not surpassed anywhere in the world at the present day. In addition to formulating hygienic laws these ancient sanitarians went in for large sanitary works. Jerusalem had an excellent water supply, a well administered system of removal of organic waste, and probably a destructor in the Valley of Hinnom. Nineveh installed a drainage system many thousands of years ago. In the King's Palace in Crete an excellent system of water carriage removal of excreta had been quite recently found. Rome undertook gigantic and successful civic works of water supply and sewerage (much of which was still in use), formulated laws relating to nuisances, and enforced them through medical officers of health and sanitary inspectors. In the middle ages the absence of sanitary laws produced the plague and the Black Death, which were practically the same as the epidemic which afflicted India and troubled Sydney and Brisbane. A quarter of the population of Europe was swept away in three years as the result of the plague in the middle ages. After detailing the terrible results of the plague at that period, the lecturer said that it finally went away owing to a change in the trade routes from the East rather than to any change in the sanitary laws. Small-pox had committed tremendous ravages till it was curbed by the discoveries of Jenner. The progress of public sanitary legislation depended to some extent on the amount of public money available for the purpose. Each individual member of the State had a certain money value, provided he was a productive worker, and it should be a point of national economy to prolong his life, and to make the conditions such as would prevent him from falling ill and becoming a burden to his family or the State. Typhoid fever destroyed a number of lives, and was yet a perfectly preventible disease. "If it is preventible," the King said on one occasion, "why not prevent it?" The standard of a community's progress could be gauged by its sanitary administration, and by the proportional fund allotted for the purpose. The attitude of the public towards sanitary reform was an important factor, as on that would depend the amount that would be voted towards it. It was of the utmost importance that the public should be educated on this subject. The lecturer then gave numerous instances where diseases had been prevented by sanitary measures.

Coming to Tasmania, the lecturer said *that during* the 12 months ending on *June 30 of the present* year there had been notified in this State 193 cases of typhoid, 147 of scarlet fever, 160 of diphtheria, in addition to consumption, which was not a notifiable disease, but in 1904 there had been 114 deaths reported from it. Consumption and typhoid were among the easiest to deal with by organised efforts in the direction of prevention and limitation. They were typically preventible diseases, and there was no reason why they should not be dealt with in Tasmania as effectively and thoroughly as malaria had been dealt with in Klang. Our vital statistics compared excellently with those of other States, but our returns of preventible disease pointed to the need for early and effective action if we were to retain our reputation as a sanitorium, not only for Australia, but for countries far beyond Australia.

Public health was never likely to become a burden upon the community, but its neglect would always be one. At present its State administration in Tasmania cost 2.16 pence per head of the population per annum. He did not say that effective central sanitary administration could be got for 2.16 pence per head of the population, but he had no hesitation in stating that if the individual share were increased to the portentous sum of sixpence per head per year, real efficiency could be within our reach. Ninepence per head per year would be absolute luxury, providing for sanatoria and other badly-needed structural appurtenances, enabling the State to relieve and assist local bodies and their officers, and rendering any repetition of the Launceston affair of 1903, which cost the taxpayers nearly £20,000, to all intents and purposes impossible, so far as human endeavour could prevail. Victoria spent 4.2 pence per head per annum; New South Wales 5.8 pence; and New Zealand—a country which, like ourselves, had a special interest in the attraction of visitors—9.6 pence per head per annum. Even the daring ninepence would not, therefore, render Tasmania a dreadful example of acute sanitary taxation, particularly when her special circumstances were taken into account.

Similarly the burden imposed upon local taxation for public health purposes could never be very heavy. At present we had the spectacle of certain rural municipalities without any local taxation whatever, although their combined annual rateable value was nearly £60,000. The cities and most of the larger and more progressive centres were showing an increasing tendency to recognise the benefits of applied sanitation, with satisfactory results, but the greater part of the State was barbaric in its primeval insanitation. The total annual rateable value of the local government districts of the State nted to about a million of money, no reasonable system of local sani- rating eked out by combination of ning districts for purposes of inspec- etc., could be expected to hit the ayer at all heavily. It would thus pparent that the country was in no r of being ruined by wild sani- ns, either now or in the future. On ther hand, however, there was a good of evidence to show that continued y and neglect were likely to cost us at deal more, individually and collec- , than the most advanced system of al and local sanitary administration ver cost.

Excellency said the paper just read o important that he would suggest lvisability of making it the sole sub- of discussion at the next monthly ng of the society.

op Mercer said it would help mat- f Dr. Elkington's paper were placed them in print before the next ng. Perhaps the Government might it for the society.

esolution was passed, asking the Go- ent to print the paper, as sug- l.

Excellency then called for questions or remarks on Mr. Murray's paper, but none being put,

Mr. Murray said his original intention had been to speak as to the fuel values of coal generally, and the different ways of treating each one to get the most out of it. He mentioned an instance in which there were 14 different veins of coal, one above the other, with hundreds of feet of sandstone and shale in between. If one thought of the time required for 14 forests to grow, and for a deposition of sandstone over all these different seams, it almost took one's breath away. In working the lowest of these seams the miner passed in a few minutes from the bottom to the top; the period traversed representing millions of years.

His Excellency moved a vote of thanks to Mr. Murray and to Dr. Elkington for the papers read. For literary skill, conscientious ability, and for interest, it would be very difficult to find two papers of such merit. He thought the greatest compliment he could pay to the authors was not to draw any comparison between them. He asked the audience to thank them for the intellectual treat they had afforded their listeners.

The applause which followed was most cordial, after which the proceedings terminated.

# ABSTRACT OF PROCEEDINGS, AUGUST. 1905.

## MONTHLY MEETING.

At the monthly meeting of the Royal Society of Tasmania last evening, His Excellency the Governor (Sir Gerald Strickland) presided; Lady Strickland, with Miss Drummond and suite, being also present.

### Public Health Work.

The meeting first discussed Dr. Elkington's paper on "Some economic and social aspects of public health work." Mr. Nat Oldham attended with his lantern, and with the aid of which illustrated some insects which are transmitters of disease.

His Excellency, in opening the discussion, said the paper proved very fascinating to him, and he had gone over it at least four times. He had almost completely failed to find points to criticise. It was written in an exceedingly bright and epigrammatic style well sustained throughout. (Hear, hear.) Dr. Elkington had been in contact with epidemics of plague in India, and Tasmania was now fortunate in having the advantages of it, though our conditions here were very different. We had no problems arising from congested populations. It was just the contrary. Our population was sparse, and we lived in one of the most healthy parts of the world. Yet the public health, and the care and nurture of infantile life needed such an officer to guard them; also in aiding to increase the reputation of the State as a health resort, thereby attracting to Tasmania an ever-increasing number of the most eligible people from other parts of the world and the Australian Commonwealth. He doubted whether the system obtaining in Tasmania of reporting infectious diseases was as efficient as Dr. Elkington implied. The result of his (His Excellency's) observations was that it was not, owing to difficulties, thoroughly efficient anywhere. Certainly, if it was so in Tasmania, it was very greatly to the credit of the Health Department, for, after all, it was the key of success in sanitary science, and the only hope for the abolition of the antiquated and often impossible quarantine laws. He ventured to disagree with Dr. Elkington as to the yellow fever being more likely to threaten the western seaboard, including Australia, and especially Tasmania and New Zealand, by the opening of the Panama Canal, though he did not deny its impossibility. And if it did reach our shores, he thought it would be successfully stamped out with not very serious *trouble. The danger of* its reaching the colder climates of Tasmania and New Zealand he thought was still more remote.

Dr. Gerard Smith spoke in commendation of the aid of local authorities in matters of public health; but it was very necessary that they should co-operate with the head of the State Public Health Department. He thought that the therapeutic side of the medical profession was paying great attention to preventive medicine.

Dr. Crouch commended the paper.

Mr. Clemes spoke in sympathy with what the paper had said on the importance of preventive medicine.

Mr. Russell Young said the intelligent way in which Dr. Elkington had brought the subject before the public quite justified the action of the Government in obtaining the services of such an able and independent medical gentleman to take in hand the control of the general health of the community. (Applause.) He emphasised the importance of the health of the people, and especially in Tasmania, which was becoming such a noted health and holiday resort.

Mr. R. M. Johnston spoke of the noble purpose of the paper, and the great public service which Dr. Elkington discharged. Dr. Elkington's directing skill in the interests of public health was of great value and importance. Infantile mortality stood lower in Tasmania than in the other States.

Bishop Mercer wondered why it was that the large amount of insanitary environment among Jewish communities in great cities did not so much affect their health as other people. He was told that they had longer bodies. (Laughter.) Perhaps Dr. Elkington could explain. The State should make some better regulations for the protection of health in mining districts. It was very striking the marvellous advantage the Japanese army derived from attending to sanitary matters. He wished to add his tribute of thanks to Dr. Elkington for having contributed such a valuable paper to the society and the State, and trusted it would do much lasting and far-reaching good. (Applause.)

Dr. Elkington, in replying to the discussion, said that notifications of fevers and contagious diseases were now received in the great majority of cases in Tasmania. He joined issue with His Excellency as to the danger of yellow fever reaching Australia through the Panama Canal, and quoted Manson, a great authority on the subject, to show there was a danger, and Manson was the greatest authority on tropical medicine. The physical characteristics of the mosquito that conveyed yellow fever were such as to enable it, under given conditions, to be a potent and dangerous factor. It was the best of all sea travellers of the mosquito family, and its distribution was well-nigh universal. A close connection of that mosquito existed in Tasmania, particularly on the East Coast, namely, the Stegomyia notoscripta, the other being the Stegomyia fasciata. Certainly, Tasmania's cold climate was a protection. As to what the Bishop of Tasmania had said in reference to the Jews, their superior health in congested and insanitary surroundings was due to the excellent domestic management of the Jewish women. In many points they set an example to their sisters of other faiths. It was exceedingly rare to find their children fed artificially; their cooking was good, and they were particularly keen in the observance of their religious duties and rites. As to the absence of sanitation in mining districts, he was painfully aware of it. It was almost wholly due to a lack of sanitary inspection and enforcement. As to the care and feeding of infants, he hoped, with the aid of the Director of Education, to soon have practical demonstrations given to girls in school on the subject. Referring to the work of local authorities, he acknowledged that the City Local Board of Health and its officer formed a shining example to local sanitary authorities in Tasmania. But local sanitary authorities were not invariably essential. In New Zealand they were retained, but were more or less of a phantom, for there the State took up practically all the work.

A hearty vote of thanks was passed to Dr. Elkington for his paper amid applause.

### The Housing Question.

Bishop Mercer read a paper on "The Housing Question," reviewing certain economic principles bearing thereon.

Discussion on the paper was postponed till the next meeting.

### New Member.

Mr. J. Adam was unanimously elected a Fellow of the society.

### Obsidian Buttons.

Mr. Morton (the secretary) read a paper on "Record of Obsidianites or Obsidan Buttons in Tasmania," prepared by Mr. W. H. Twelvetreees, F.G.S. The author said during recent years some more of these interesting, though still mysterious objects have been found in Tasmania, and it seems desirable to place the localities on record, as a knowledge of their distribution and conditions of occurrence may assist in forming some idea of their age. Mr. Twelvetrees said the locality-list brought up to date stands as 22 specimens of Obsidian buttons found in Tasmania. The writer further said: "'It might be as well to record the information obtained as to their occurrence before the particulars pass into oblivion. It seems to be clear, said Mr. Twelvetrees, that no evidence has come to light which would require us to assign to them a date so far back as early or middle tertiary. They have nowhere been found in gravel protected by the middle tertiary basalt." Mr. Twelvetrees said he had repeatedly made inquiry at Derby (Tasmania), but always with negative results.

The proceedings then terminated.

## ABSTRACT OF PROCEEDINGS, SEPTEMBER, 1905.

The monthly meeting of the Royal Society of Tasmania was held at the Tasmanian Museum on Tuesday evening, 12th inst. His Excellency Sir Gerald Strickland, who was accompanied by Lady Edeline Strickland, and attended by Captain Maclean Griffin, A.D.C., presided.

### The Housing Problem.

His Excellency introduced the discussion on a paper read by the Bishop of Tasmania at the previous meeting on the housing problem, and referred to the exhibition of model cottages for working men recently held in London. The cottages contained four or five rooms, and were erected at a cost of about £150.

Mr. R. M. Johnston said that the question was one of great importance, and it remained now to do something in a practical way to benefit workmen in the city who received a comparatively small wage. He had consulted some friends on the matter of arriving at some method of attempting an experiment of the nature indicated in this city. At the same time, he did not see how anything could be done for the improvident poor. He thought that much might be achieved if a spot in proximity to Hobart could be found on which to erect experimental dwellings. Perhaps the municipality, with the authorisation of the ratepayers, might be able to utilise the slaughter-house site for that purpose. The matter was, of course, one for a corporative body, and not for divided individual effort. For £5,000 two rows of ten cottages might be erected, and if the money were raised on favourable terms the experiment should prove successful, and the cottages might be let for 4s. a week. That could all be done without exposing the city to any appreciable risk; certainly not more than ¼d. on every £15 of annual value of city property. The scheme should be taken up in a whole-hearted manner, and everything was to be gained by inducing all the citizens to interest themselves in the project. There were evidences that the standard of comfort enjoyed by the majority of working men in Hobart was above that enjoyed by similar classes in almost all cities of the world. Not above 5 per cent. of the people in Hobart occupied houses of less than three rooms. If the cost of the scheme he had projected were spread over all the citizens, they would, individually, have little to bear, especially as the rent would be almost sufficient to defray the interest on the capital required.

Dr. Gerard Smith thought that the City Council per se was not the body to which they should look to initiate such an enterprise. He thought that the duties of the Corporation in these matters should be of a supervisory character. Again, the municipality should only build for the purpose of getting rid of insanitary areas. Dr. Gerard Smith also thought that something should be done for the drunken and improvident; but in this instance, too, the work could be well entrusted to private enterprise. The same was true of the scheme suggested by Mr. Johnston.

The Bishop of Tasmania referred to the point raised by Dr. Gerard Smith as to who should bear the responsibility of providing housing for the working classes, and went on to say that he thought the duty rested with the whole community. He also thought that if the community was content to sit down and do nothing, whilst the army of industrial workers was paying a quarter of their weekly wage in rent, it would be lacking in its duty. The task should be undertaken in the manner suggested by Mr. Johnston, for then every member of the community would perform his part. The question then arose, who should act for the community? He agreed with Mr. Johnston that it would be the duty of the Corporation to undertake the work; but, provided the community acted as a whole, he was not particular what body was entrusted with the executive work in connection with the scheme.

### Dundasite.

The Secretary (Mr. Alex. Morton) read a paper prepared by Mr. W. F. Petterd, entitled, "A note on the occurrence in Wales of the mineral dundasite which was supposed heretofore to be peculiar to Tasmania."

In a catalogue of the minerals known to occur in this island, which was published in the proceedings of this society for the year 1896, I brought under the notice of mineralogists for the first time the occurrence of a mineral of remarkable chemical composition, to which was applied the specific term of dundasite, and I have now the satisfaction of bringing under notice the recognition of the original diagnosis by the announcement of the detection of this interesting substance at the Welsh Foxdale mine, Trefrico, Carmarthenshire, by Mr. H. F. Collins (the author of "The Metallurgy of Lead and Silver"), and on which discovery a paper has been read before the Mineralogical Society on March 15 by Mr. G. T. Prior ("Nature," April 13, 1905). Dundasite is a mineral substance of extremely unique and peculiar composition, and up to the time of its determination as occurring at the silver-lead mines of Dundas, was previously unknown to mineralogical science,

uch a vast amount of research
been accomplished among the
secondary lead salts. Its de-
, therefore, of special interest,
lowed that its characteristic
led with its composition, neces-
t a specific name should be ap-
. As it was considered to be
to the Adelaide Proprietary
e locality indicated on account
l peculiarities necessary for its
growth, the term Dundasite
d to it. Under what conditions
what associations it has been
s newly recorded locality is not
y apparent, but the interesting
is that a new mineral originally
in this island has been ob-
a special locality in the old
is in itself is worthy of record.
v some additional information
to its distribution at the mines
s, and its detection at other
n the West Coast. Its general
currence is in somewhat small
ggregates closely packed to-
ich show white radiating tufts
ion. It is easily disintegrated
lky fibres after the manner of
In many instances the in-
ft has as a nucleus a minute
the bright hyancinth-red col-
icite, which is again sometimes
on its surface. It often occurs
interior of vughs in the harder
anese gossan which is immedi-
th the softer superificial lode
ad in the zone above the un-
mary sulphide minerals. At
l locality it is occasionally
h an outer film of extreme
ad of a bright green colour.
obably a substance allied to
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tisfactorily determined. It is
times stained on the exterior
t of copper to a pale bluish
more rarely discoloured by
lrated iron oxide. At the
ine at Mount Read it has been
are occasions in a very pure
vhen it is immaculately white,
n isolated internally radiating
small aggregates on cellular
d yet more rarely on crystals
, closely associated with an-
lead mineral which has been
rocerussite. These groupings,
ery attractive, are extremely
thus most difficult to preserve
inet, but through the kindness
general manager, Mr. Sydney
s enabled to secure a specimen,
lly large and very beautiful.
btless the finest example which
been obtained, but needless to
nply of scientific interest. At
e mine at Zeehan the mineral
w occurs sparingly in gossany
cavities, but much iron-stained, and at a few other mines it has occasionally been met with, but never in any appreciable quantity.

Mr. R. M. Johnston thought that it was a matter for congratulation that Mr. Petterd's discovery, which had been announced to the society some time ago, had been confirmed by another discovery in Great Britain. Mr. Johnston also spoke of the services to science rendered by Mr. Petterd.

### Evolution of Language.

The next paper was one read by Professor H. B. Ritz on the "Evolution of Words." After some introductory remarks, Mr. Ritz stated his thesis in the following terms: — The meaning of a primitive word is expressed by the musical pitch of the sounds of which it is composed; and (2) the changes which words undergo in the course of time and under various circumstances are governed by the psychic life of the speakers expressed by variations of pitch and emphasis. The true origin of any word was, he said, the feeling evoked by the thought it signifies. The feeling occasioned by any object differs according to circumstances, and its vocal expression reflects not only the generic feeling, but its specific modification in a particular case; and it may appear as a voluntary exclamation or as conscious or unconscious imitative gesture of the vocal organs, but is always in accord with the feeling. Mr. Ritz exemplified this general rule by pointing out the significance of pitch in laughter, and also of the arrangement of syllables bearing tonic accents in rhythmic utterance. Musical pitch was also an expression of emphasis, the emphatic word being not only louder, but of a higher pitch than its neighbours. Thus, Mr. Ritz insisted, musical pitch is a prominent and important constituent of human speech. Not only is each part of a word of a specific pitch, but the successive parts are at concord or discord with each other; and, as in pure music, so in the applied music of human speech, the natural tendency is to avoid discord and effect concord. Consequently our phonetic alphabet must be a kind of musical scale in which every speech sound may find a place. After describing the mechanism of speech, Mr. Ritz dwelt on the psychological character of the different musical keys, and pointed out that as a matter of common experience a different pitch of the same word corresponded with a different state of the speaker's mind. From an examination of a particular sound occurring in different words it might be possible to arrive at its meaning, and to determine the feeling which prompted its utterance. Dealing with the principles of the evolution of words, Mr. Ritz laid it down that the meaning

of a primitive word is expressed by the musical pitch of the sounds of which it is composed, and passed on to the proposition that the changes which words undergo in the course of time and under various circumstances are governed by the psychic life of the speakers, and are expressed by variations of pitch and emphasis. Mr. Ritz contended that in the case of any change in one part of a word, the musical pitch of the other parts was of decisive importance. The conclusions arrived at were, briefly, that there exists in practice a musical scale of speech sounds which embraces all of them; that consonants are differentiated according to meaning and emphasis; that in the process of adaptation of the parts of the words to each other the direction of least effort is that of approximation to the pitch of the most prominent part; that the changes which words undergo in passing from one vocabulary to another are the effects of the influence of the psychological character of the people using the different vocabularies. Finally, Mr. Ritz stated that his theory supplied a rational basis for the study of p
as a part of ethnology and psych

This paper will be discussed at
meeting of the society.

### Colour Photography.

Mr. A. D. Arundel, an English
delivered a very interesting lectu
"Colour Photography." There
said, at present no complete m
colour photography, though exp
in photographing through coal ta
to promise some success. Ha
scribed the three-colour method o
discovered by Clark Maxwell
years ago, and also the super
method, which was illustrated b
light views, the lecturer had som
graphs taken by the latter meth
jected on a screen, and although
ditions were unfavourable, the
were sufficient to show what prog
been made towards a solution of
blem.

His Excellency moved a vote of
to the contributors of papers, afte
proceedings terminated.

ting of the Royal Society
at the Museum on Tues-
10th inst. His Excellency
nor (Sir Gerald Strickland,
presided, and among those
ere Lady Edeline Strickland,
mmond, Capt. Griffith, A.D.C.,
Lewis, K.C.M.G., Mr. A. G.
chairman of the council), Dr.
Messrs. A. O. Green, Lomas
d a number of ladies and gen-

business was the balloting for
mber, Dr. E. M. Owens being
ly elected.

### o Noteworthy Exhibits.

etary (Mr. Alex. Morton) apolo-
the absence of Messrs. Russell
rnard Shaw, I.S.O., Thos. Ste-
A., and Professor Neil-Smith,
drew attention to two very
exhibits. One was a fine speci-
rainbow trout, weighing 4½lb.,
been placed in Lake Dulver-
ch in length on November 21,
rainbow trout (Salmo iredeus)
ally abundant in the mountain
California. Its size depended
urroundings, the volume and
re of the water, and the amount
contained. In some of the
tain streams of Colorado their
ight was not more than 6oz. or
lakes in the same State, where
was moderately warm in sum-
reached 12lb. or 13lb. The other
as a specimen of wolframite
of iron), which had recently
d at Ben Lomond, and would
prove to be one of the most
inerals ever discovered in Tas-
his mineral had recently be-
onsiderable commercial import-
he production of tungstic acid,
principally used to give great-
s to steel and aluminium. Rus-
bout to spend twenty million
rebuild her ships, and Krupp
ut an expert to search for this
mineral, which was now
d for the manufacture of war

### he Activity of Science.

rtant circular was read from
n Lockyer, president of the
committee, stating that an as-
vas being organised under the
he British Science Guild, with
of insisting upon the import-
pplying scientific methods to
ch of the affairs of the nation.
npanying memorandum stated
that it had been a frequent subject of comment that the English people did not manifest that interest and belief in the powers of science, which were noticeable among the peoples of the Continent or of America. In spite of the efforts of many years, the scientific spirit was still too rare, and was often lacking in some of those who were responsible for the proper conduct of many of the nation's activities. It was proposed, therefore, to establish a British science guild, which would be entirely disconnected from party politics—(1) To bring together all those throughout the Empire interested in science and scientific methods, in order, by joint action, to convince the people, by means of publications and meetings, of the necessity of applying the methods of science to all branches of human endeavour, and thus to further the progress and increase the welfare of the Empire; (2) to bring before the Government the scientific aspects of all matters affecting the national welfare; (3) to promote and extend the application of scientific principles to industrial and general purposes; and (4) to promote scientific education by encouraging the support of universities and other institutions where the bounds of science were extended, or where new applications of science were devised.

Another important circular was a preliminary announcement of an Australian Journal of Science which it was proposed to issue monthly, edited by Professor Liversidge, M.A., LL.D., F.R.S., of the Sydney University, to commence next January.

### A Difficult Subject.

The Chairman then called for a discussion on the Philological paper read at the last meeting by Professor Hermann Ritz, of the Tasmanian University.

Mr. R. M. Johnston, Government Statistician, said that the subject was a very difficult one to follow, too difficult, indeed, for anyone to criticise who had not made it a special study. They felt very much indebted to the professor for having given them the results of his researches. While they might not, perhaps, follow him in all his conclusions, they appreciated the value of his labours. He specially agreed with the professor on one point, and that was that the need for expression must have preceded the expression itself.

### A New Range Finder.

Mr. H. C. Kingsmill, M.A., then read a short paper, entitled "A New Range Finder." Although range-finding was commonly regarded as a military art, there were occasions when it was a useful adjunct to the work of the civilian explorer or surveyor. The requisites for the new method were a box sextant, a steel tape or surveyor's chain, and a couple of ranging rods with some arrows. An assistant to the surveyor was also required, whose work would be of a very simple nature. After illustrating his subject by diagrams, Mr. Kingsmill said the range could be obtained without calculation by means of a table of reciprocals, such as was found in Molesworth's "Book for Engineers." The instruments used were those with which a surveyor was supposed to be familiar, and they were easily carried. Though no trial had yet been made with a long range, a satisfactory result had been obtained at short ranges. For a rapid geological or topographical sketch a sufficient degree of accuracy should be attainable.

The Chairman asked if the new range-finder, which depended on two points of observation, could compete for practical work with instruments which required only one point. There was nothing so useful as the theodolite, especially when combined with the calimeter, and he would like to know whether it would not be more rapid and reliable, although perhaps more expensive, and a more satisfactory instrument for obtaining ranges than the one proposed by Mr. Kingsmill.

Mr. Kingsmill said that his method could not compare for accuracy with the calimeter and theodolite, but he would be sorry to carry the theodolite to places where he could easily carry the other. The idea had occurred to him, on hearing that Colonel Legge contemplated an expedition to the plateau on the top of Ben Lomond. The Colonel intended to do the work with a plain table, and this new method had been designed to assist.

## Stereoscopic Photography.

Mr. W. E. Masters, B.A., LL.B., next delivered a very lengthy and fluent address on "Stereoscopic Photography," illustrated by numerous diagrams. The effect produced by viewing a picture through the stereoscope for the first time was an appearance of reality, which cheated the senses with its seeming truth. Ordinarily, when viewing a photograph the same height and breadth only, distance and solidity were suggested merely by the arrangement of high lights and shadows, but in the stereoscope we experienced a sense of relief or solidity, the mind feeling its way into the depth of the picture. The effect was analogous to that produced by listening to a familiar voice through a telephone. We did not hear the speaker's voice, but a mechanical reproduction of it, the instrument transmitting air waves in all essential respects the same as caused by the voice. *So in the stereoscope* the pictures caused *undulations of the luminiferous* ether
which affected our ograns of si
the original scene depicted wo
saving, of course, the impress
movement and colour, the illu
reality in each case being perfe
was known to the ancients that e
received a distinct impression.
demonstrated this 2,000 years
means of geometrical figures, but
not until 1838 that the first ster
an instrument enabling the eyes
two dissimilar views, was inve
Charles Wheatstone. In his ins
an arrangement of mirrors assis
eyes in blending the pictures, but
after his instrument was produ
David Brewster devised one on a
different principle, that of the re
of the rays of light by semi-len
this, with certain minor impro
was the instrument at present u
first, stereograms were drawn b
but with the discovery of the
photography by Louis Daguerre,
the geometrical designs were repl
photographs. At the exhibition
95 per cent. of the photographic s
were stereoscopic. The beautif
light photograph was the latest
ment in the art of stereoscopic
graphy. The pictures, which n
of any size, were taken from
angles, and were printed in com
tary colours, and partly super-i
being viewed through colour filte
screened off all colours, allowing
to see its appropriate picture o
brain blending the two impressio
views exhibited included scen
England and the Continent, and
markably beautiful; objects stan
in the foreground with startling
This system, observed Mr. Mast
as yet in its infancy, and wou
ably solve the problem of p
stereoscopic views by means of t
light lantern. The Kromaz ste
an instrument adopting the supe
ed print method of three colou
graphy, was exhibited for the fi
in Hobart, a vase of flowers bein
ed, standing out in bold relief in
colours.

At the conclusion of the a
discussion ensued, in which th
man, Mr. Horatio Yeates, and M
mill took part,after which, on th
of the Chairman, a hearty vote o
was tendered to Messrs. Kingsm
Masters for their addresses, Hi
lency warmly complimenting the
the able manner in which he ha
his subject.

The Secretary announced that
meeting of the season would be
the second Tuesday in Novemb
Mr. R. M. Johnston would cont
paper on "The ethical, economi
practical aspects of old-age p
and Dr. Gerard Smith would
some interesting photographs of
temples.

# ABSTRACT OF PROCEEDINGS, NOVEMBER, 1905.

## TROPICAL AUSTRALIA AND OLD-AGE PENSIONS.

His Excellency the Governor, Sir Gerald Strickland, K.C.M.G., presided at the monthly meeting of the Royal Society of Tasmania last evening.

In apologising for his absence, Colonel Legge wrote, calling attention to the death of Captain Hutton, F.R.S.E., and suggesting that some steps should be taken to perpetuate his memory.

Mr. R. M. Johnston feelingly referred to Captain Hutton's death on his way back from a trip to England, and who, he said, was one of the most industrious and eminent of Australasian scientists. Captain Hutton was president of the Australasian Association of Science at its Hobart meeting. He moved,—"That the news of Captain Hutton's death be recorded on the minutes with deep regret; that a letter of condolence be sent to Mrs. Hutton; and that kindred societies in Australia be communicated with, advocating steps being taken to perpetuate his memory."

Mr. A. G. Webster seconded the motion, which was passed.

### Old-Age Pensions.

Mr. R. M. Johnston read a paper on the subject of old-age pensions, apart from political aspects of the question, dealing with the ethical and economic aspects of it. He claimed that it was purely an economic question in relation to the State. The present breadwinners supported the rising generation, who would be the future breadwinners, and were therefore ethically, economically, and justly entitled to an old-age pension where required. He gave a mass of figures, showing how the proposal would work in relation to both the Commonwealth and Tasmania as one of the States. He estimated that about 1.38 per cent. of the population of Tasmania, of the age of 65 years and upwards, would require the pension. He showed that there are at present in the Commonwealth of Australia a population (exclusive of aborigines) of 3,984,376 persons, of whom it is estimated that 159,375, or 4 per cent., are of the age of 65 years and over. By the seven years' experience of New Zealand, it might be safely reckoned, under the conditions prescribed there for old-age pensions, that about 55,781 persons, or about 35 per cent. of the old-age group (65 years and over), would become pensioners. This, at the average pension of £17 per annum, would represent a cost to the Commonwealth States of £948,177 per annum, and a tax of 4s. 9d. per head. The burden and effect of such a pension to each State on the basis of population was then given, that for Tasmania being estimated as follows:—Percentage of persons, 65 years and upwards, to the total population, 4.52; old-age pension cost, £42,858. Mr. Johnston then proceeded to show that the proposal was practicable and workable. New Zealand had indicated it where only 1.38 of the population had needed it, or 3 per cent. of the old-age group. Last year it cost the New Zealand Government £195,000.

Mr. Ogilvy very warmly commended the paper, but time did not permit of discussing it.

### Tropical Australia.

Dr. Elkington read an exceedingly interesting and instructive paper on "Tropical Australia—Is it fitted for a working white race?" He first answered the question, "What is tropical Australia?" It comprised rather more than one-third the entire Commonwealth territory. One-half of Queensland, 523,620 square miles of the northern territory of South Australia, and the north-western divisions of West Australia are included, totalling in all some 1,145,000 square miles. Much yet remained to be opened up, but enough was known to justify bright anticipations of its commercial future. The mines of Chillagoe and Charters Towers testified to the existence of mineral wealth in the east, and mineral deposits are known to exist in the northern territory of South Australia, while the Kimberley districts have not yet been fairly investigated. The presence of so many streams pointed to an economic and profitable source of power for the development of mining and electric-metallurgical industries. The sugar industry of the eastern part of North Queensland formed a valuable addition to the resources of that State, but it did not comprise more than a small part of the agricultural possibilities of tropical Australia. The country ranges from the Pacific to the Indian Oceans, included practically all ordinary varieties of tropical climate, and was dominated by the monsoonal winds. The greater part of it lies between 600ft. and 1,500ft. above sea level; but extensive plateaus exist, covering many hundreds of square miles, at an elevation of over 1,500ft., and ranging in Arnheim Land to 3,000ft. and over. Elevation materially modified climate, and the breezy table-lands of eastern North Queensland at least afford, for many months of the year, as bracing an atmosphere as could be found anywhere in the world. Drought is a rare phenomena

in the monsoonal area, and the great northern rivers testify to the abundance and regularity of the annual revivification from this cause. These also afforded waterways for a considerable distance into the interior, and drained extensive areas of good pastoral country. Very large cattle runs have been taken up, and in the first six months of 1904, some £500,000 worth of cattle were exported from the northern territory alone. Where good pastoral land was plentiful in a well-watered country, it may be reasonably concluded that good agricultural land was not absent. It was already known that the finest quality of cotton could be produced in parts of tropical Australia; the cultivation of tobacco, maize, dates, quinine, spices, opium, and other profitable vegetable products, appeared to require only the necessary population; also the breeding of goats for mohair and hides, raising of poultry, dairying for export, etc. Tropical Australia was by no means an earthly paradise, neither was it a fever-smitten jungle, as some would have them believe. It already supported, in parts, a fairly considerable white population, who did not appear to be degenerating, despite the recklessness and ignorance so often displayed in relation to personal health and habits. Certain diseases exist, notably malaria, dysentery, and ankylostomiasis, but their incidence was mainly local, and the methods of prevention well known Their limitation and eventual extinction was mainly a question of money. Dealing with the objections raised to the occupation of tropical Australia by a working white race, Dr. Elkington made light of objections to tropical climates by the practice of tropical hygiene, the use of sanitary and preventive precautions, and the adoption of a suitable dietary. So much hinged upon domestic and personal environment and habits. Impure water, improper food, and general neglect of the rules of health, will produce much the same effects, whether the victim resides in Melbourne or Palmerston. Although there appeared to be no insuperable, or even serious, bar to the ultimate colonisation of tropical Australia by a working white race, certain sanitary and other measures, which he indicated, involved much public organisation and outlay, especially in the direction of preventing and stamping out infectious diseases. Tropical Australia was no place for weaklings and degenerates. Newcomers must be taught how
to suitably live, suitable dwelling
pied, use of alcohol interdicted, an
lations made as to working hours,
the climate. He concluded—"Befo
definite move can be made, much
will require to be accurately know
cerning the topographical, and oth
ditions of the country. From wh
be gathered, however, the institu
an inquiry should be amply justifi
this age of land hunger, Austral
not continue to act as the dog i
manger. Given sufficient industr
traction, population will soon be
coming, and there appears to be n
reason why that population should
a white one. Should the initial
ties appear too great, the alternati
coloured population is always f
but I, for one, would regret t
that the national pluck and en
upon which we Australians are rat
to pride ourselves is insufficient t
difficulties to be faced which ha
met and overcome elsewhere und
favourable conditions."

Mr. Moore, M.H.A., questioned
Dr. Elkington had conclusively
that in a tropical climate, as in
white people could develop or mai
good physique and perform
labour.

### Ancient Egyptian Architectu

Dr. Gerard Smith, with the aid
tern slides manipulated by Mr
Oldham, gave an exceedingly int
and instructive address on archi
forms, and the different kinds
ples, pyramids, etc., of ancient
with explanations of their ethn
significance.

At the close of the meeting, Mr
Webster moved a vote of thanks
Excellency for his constant att
and presiding at the meetings of
sion, which was passed amid hea
plause.

His Excellency assured them
was a very great pleasure to him
meet the leaders of scientific tho
Tasmania. He suggested that
able papers which had been re
evening should be discussed at th
ing of the 1905 session. He a
mended the energy, devotion, and
of the secretary Mr. Alex. Mo
organising the meetings. Appl

The proceedings then terminate

# LIST OF ADDITIONS TO THE LIBRARY.

following is a list of the principal fic works recently presented to the of the Royal Society of Tas- :—

ı the trustees of the British m:—

logue of the collection of birds' n the British Museum. Vol. itæ, Carinatæ (Tinaminormes-Lari- ). Vol. II. (Charadriformes-Strigi- ). Vol. III. (Psittaciformes-Passmes). Plates. 1901-03. By Eugene tes.

l - list of the genera and of birds. Vols. I., II., III., and By R. Bowlder Sharpe, LL.D. 03.

logue of the Arctiadæ and tidæ, in the collection of the ı Museum. Ditto, ditto, of the dæ. By Sir G. F. Hampson. 1901. Catalogue of the collec- Palæarctic butterflies, formed by te John Henry Leech, and present- he trustees of the British Museum mother, Mrs. Eliza Leech. By South, F.E.S., 1902.

graph of the Culicidæ or mosqui- nainly compiled from the collec- eceived at the British Museum arious parts of the world in con- ı with the investigation into the of malaria, conducted by the al Office and the Royal Society. ., II., and III. Plates. 1901. By Theobald, M.A., F.E.S.

Report on Economic Zoology, by Theobald, M.A. 1903.

trations of the Botany of Captain voyage round the world in H.M.S. ure in 1768-71. Parts I., II. Australian Plants, by Sir Joseph Banks and Solander, 1901.

logue of the African plants, col- by Dr. F. Welwitsch, in 1853-61. ., part II., "Cryptogamia," 1901.

logue of the Madreporian corals in ritish Museum. Vol. IV. The Poritidæ. 1. The genus Goni- by H. M. Bernard, M.A. Plates.

ified list of photographs of works orative art in the Victoria and Museum, and other collections. textile fabrics, and lace; part 4, mith's work, jewellery, enamels, s, jade, etc., heraldry. Illus-

logue of photograhps, consisting of cal and architectural subjects, and from Nature chiefly contributed J. Benjamin Stone, M.P.

Catalogue of the Lepidoptera Phalænæ in the British Museum. Vol. IV. Plates.

From the Smithsonian Institution, America:—

Annual report of the Board of Regents of the Smithsonian Institution, 1902. Proceedings of the U.S. National Museum. Vols. 25, 26. 1903.

Department of the Interior, No. 65, operations at river stations, 1901. Part 1, east of the Mississippi River, 66. Part 2, west ditto, ditto. No. 67, the motions of underground waters. No. 68, water storage in the Truckee Basin, California, Nevada. No. 69, water powers of the State of Maine. No. 70, geology and water resources of the Patrick and Goshen Hole Quadrangles, Wyoming, Nebraska. Sewage pollution in the metropolitan area in New York city, and its effect on inland water resources. Irrigation systems of Texas. Observations on the flow of rivers in the vicinity of New York city. Preliminary report on artesian basins in south-western Idaho and south-eastern Oregon. The water resources of Molokai, Hawaiian Islands. Normal and polluted water in northeastern United States.

Department of the Interior U.S. Geological Survey:—Report of progress of stream measurements for the year 1900. Water resources of the State of Colorado. Water storage on Salt River, Arizona.

From the Wagner Institute of Science, Philadelphia:—

Contributions to the Tertiary Fauna of Florida, with special reference to the silex beds of Tampa, and the pliocene beds of the Caloosahatchie River, including, in many cases, a complete revision of the generic groups treated, and their American tertiary species. By W. H. Dall, M.A.

From the Lloyd Library, Ohio:—

Bulletin of the Lloyd Library of botany, pharmacy, and materia medica, and mycological notes.

From the Field Columbian Museum:—

North American Plesiosaurs. Part 1. Plates. By S. W. Williston, M.D.

From the American Philosophical Society:—Proceedings of the Society. Vol. XLII. No. 173. April and May, 1903.

From the Brooklyn Institute of Arts and Sciences:—Cold Spring Harbour Monographs.—I. The Beach Flea, by Mabel E. Smallwood. II. The Collembola of Cold Spring Beach, with special reference to the measurements of the Poduridæ, by C. B. Davenport. Plate. 1903.

# LIST OF THE DESCRIBED COLEOPTERA OF TASMANIA.

By ARTHUR M. LEA.

[Reprinted from Proceedings of the Association for the Advancement of Science, 1902.]

THE Coleoptera of Tasmania have never been considered as a whole since the time of Erichson, ([a]) and no list or catalogue of the species has ever been compiled. About 10,000 species have now been recorded from Australia and Tasmania, of which scarcely 400 have been described from Tasmania. A very imperfect knowledge of what species are confined to the island exists, as species supposed only to occur there, are constantly being found in Victoria and New South Wales, and even sometimes in Western Australia and Queensland; on the other hand, Tasmanian collectors frequently obtain mainland species which have never been recorded from Tasmania.

I have considered it advisable, therefore, to prepare a list of the species hitherto recorded from Tasmania, adding to the list such species as I have seen in Tasmanian collections, or have myself taken in Tasmania. In this list, the genera and families are placed as far as possible in the order in which they appear in Masters' "Catalogue of the Described Coleoptera of Australia;" the species are placed alphabetically. All known synonyms have been omitted.

In the list an asterisk (*) has been placed after those species which are known to occur on the mainland, whilst another (†), has been placed after those species which have been introduced. Deducting the introduced species (40) there remain 1000 species and varieties, of which 423 are so far, known only from Tasmania; and one being known only from New Zealand and Tasmania; but probably many of these will be found to occur on the mainland, especially as the beetles of the Australian Alps (and Mount Kosciusko in particular) become better known.

When the Coleoptera of Tasmania have been thoroughly worked out, it will probably be found that there are over 2000 species, whilst in the whole of the Australian States, there are probably at least 20.000 species.

## CARABIDÆ.

Calosoma Schayeri, Er.*
Lacordairia anchomenoides, Cast.
Erichsoni, Cast.

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([a]) Wiegmann's Archives, 1842

**Cymindis** Illawarræ, Macl.*
**Xanthophæa** angustula, Chaud.*
infuscata, Chaud.*
**Plagiotelum** opalescens, Oll.
**Diabaticus** Australis, Er.
pauper, Blackb.
**Anomotarus** olivaceus, Chaud.*
**Homethes** elegans, Newm.*
guttifer, Germ.*
rotundatus, Blackb.*
**Dromius** Yarræ, Blackb.*
**Pentagonica** vittipennis, Chaud.*
**Trigonothops** lineata, Dej.*
longiplaga, Chaud.*
tridens, Newm.
**Sarothrocrepis** benefica, Newm.*
civica, Newm.*
corticalis, Fab.*
luctuosa, Newm.*
**Ectroma** grave, Blackb.
inquinita, Er.
**Philophlæus** eucalypti, *var.* Tasmaniæ, Blackb.
**Agonocheila** bicincta, Blackb.
binotata, White.*
biguttata, Chaud.*
corticalis, Chaud.*
sinuosa, Chaud.*
vittula, Chaud.*
Scopodes boops, Er.*
intermedius, Blackb.
Tasmanicus, Bates.
Silphomorpha decipiens, Westw.*
Tasmanica, Cast.
Adelotopus hœmorrhoidalis, Er.*
Tasmani, Blackb.
Carenum politum, Westw.*
Scaraphites insulanus, Sln.
Macleayi, Westw.*
rotundipennis, Dej.*
Clivina heterogena, Putz.*
lepida, Putz.*
vagans, Putz.*
Promecoderus Bassii, Cast.
brunnicornis, Dej.*
gibbosus, Gray.
modestus, Cast.

Promecoderus ovicollis, Cast.*
subdepressus, Guer.
Tasmanicus, Cast.
Percosoma carenoides, White.
percoides, Cast.
sulcipenne, Bates.
Lychnus ater, Putz.*
Gnathaphanus Adelaidæ, Cast.*
Anisodactylus rotundicollis, Cast.*
Diaphoromerus Australasiæ, Dej.*
australis, Dej.*
mæstus, Dej.*
quadricollis, Chaud.*
rectangulus, Chaud.*
Hypharpax inornatus, Germ.*
latiusculus, Chaud.*
Thenarotes Tasmanicus, Bates.
discoideus, Blackb.*
Notophilus niger, Blackb.*
parvus, Blackb.*
Harpalus promptus, Er.
verticalis, Er.
vestigialis, Er.
Drimostoma alpestre, Cast.*
Oopterus Tasmanicus, Cast.
Amblytelus curtus, Fab.*
Pterostichus coracinus, Er.
Catadromus Lacordairei, Boi.*
Notonomus chalybeus, Dej.*
politulus, Chaud.
tubericauda, Bates.
Rhabdotus Diemenensis, Cast.
floridus, Bates.
reflexus, Chaud.
Rhytisternus cyathoderus, Chaud.*
liopleurus, Chaud.*
miserus, Chaud.*
Chlænioidius prolixus, Er.*
Leptopodus subgagatinus, Cast.*
Loxandrus gagatinus, Cast.
Hormochilus monochrous, Chaud.*
Simodontus elongatus, Chaud.*
orthomoides, Chaud.*
sexfoveatus, Chaud.*
Dichrochile minuta, Cast.*
punctipennis, Cast.*

Lestignathus cursor, Er.
Simsoni, Bates.
Cyclothorax ambiguus, Er.*
Platynus marginellus, Er.*
nigro-aeneus, Newm.*
Colpodes australis, Er.
dilatatus, Er.
Trechus Diemenensis, Bates.
Simsoni, Blackb.
Tasmaniæ, Blackb.
Trechodes gibbipennis, Blackb.
Bembidium Hobarti, Blackb.
Tachys captus, Blackb.*

### DYTISCIDÆ.

Pelobius Australasiæ, Clark.*
Sternopriscus Tasmanicus, Sharp.
Antiporus interrogationis, Clark.*
Macroporus Gardneri, Clark.*
Howitti, Clark.*
Necterosoma costipenne, Lea.
penicillatum, Clark.*
Schmeltzi, Sharp.*
Wollastoni, Clark.*
Antiporus femoralis, Boh.*
Platynectes 10-punctatus, Fab.*
obscurus, Sharp.
Tasmaniæ, Clark.
Lancetes lanceolatus, Clark.*
Rhantus pulverosus, Steph.*†
Copelatus nigritulus, Sharp.*
simplex, Clark.
Hyderodes Shuckhardi, Hope.*
Chostonectes gigas, Hope.*
Cybister tripunctatus, Oliv.*
Homœodytes insularis, Hope.
Eretes australis, Er.*
Hydaticus ruficollis, Fab.

### GYRINIDÆ.

Macrogyrus Howitti, Clark.*
obliquatus, Aubé.*

### HYDROPHYLLIDÆ.

Hydrobaticus australis, Blackb.*
Cercyon dorsalis, Er.

### STAPHYLINIDÆ.

**Falagria** Fauveli, Sol.*
pallipes, Oll.*
**Silusa** melanogastra, Fvl.*
**Aleochara** actæ, Oll.*
baliola, Oll.
hæmorrhoidalis, Guer.*
punctum, Fvl.*
speculifera, Er.*
**Poylobus** apicalis, Fvl.*
cinctus, Fvl.*
insecatus, Fvl.*
Tasmanicus, Oll.
**Pelioptera** astuta, Oll
**Calodera** atypha, Oll.
carissima, Oll.
eritima, Oll.*
inæqualis, Fvl.*
pachia, Oll.
Simsoni, Oll.
**Homalota** atyphella, Oll.*
chariessa, Oll.
coriaria, Kraatz.*†
indefessa, Oll.
pavens, Er.*†
psila, Oll.
sordida, Marsh.*†
**Leucocraspedum** lugens, Blackb.*
validum, Blackb.*
**Conosoma** activum, Oll.
australe, Er.*
enixum, Oll.*
fumatum, Er.
**Tachyporus** vigilans, Oll.
**Cryptommatus** Jansoni, Matth.
**Tachynoderus** hæmorrhous, Fvl.*
**Heterothops** picipennis, Fvl.*
**Quedius** cuprinus, Fvl.*
Diemensis, Blackb.
hybridus, Grav.*
ruficollis, Grav.*
Sidneensis, Fvl.*
**Creophilus** erythrocephalus, Fab.*
*var.* lanio, Er.*
**Philonthus** aeneus, Rossi.*†
discoideus, Grav.*†

Philonthus longicornis, Steph.*†
nigritulus, Grav.*†
sordidus, Grav.*†
Cafius amblyterus, Oll.
areolatus, Fvl.*
laetabilis, Oll.*
læus, Oll.*
littoralis, Fvl.*
pacificus, Er.
sabulosus, Fvl.*
sericeus, Holme.*†
Xantholinus chloropterus, Er.*
cyanopterus, Er.*
Leptacinus socius, Fvl.*
Metoponcus enervus, Oll.
Sunius guttula, Fvl.*
Scymbalium simplarium, Fvl.*
Pæderus australis, Guer.*
cingulatus, Macl.*
Simsoni, Blackb.
Pinophilus rufitarsis, Fvl.*
Oxytelus collaris, Er.
discipennis, Fvl.*
melas, Fvl.*
semirufus, Fvl.*
subaeneus, Fvl.*
vulneratus, Fvl.*
Wattsensis, Blackb.
Trogophlæus exiguus, Er.*†
punctatus, Fvl.*
Amphichroum Adelaidæ, Blackb.*
Homalium Morrisi, Blackb.
philorhinoides, Fvl.*
Tasmanicum, Blackb.

### PSELAPHIDÆ.

Eupines aurora, Schfs.
Eupinopsis perforata, Schfs.
Ctenisophus morosus, Raffr.
Schaufussia formosa, King.*
Rytus punctatus, King.*
Tychius Tasmaniæ, Schfs.
Batrisus australis, Er.
Bryaxis atriceps, Macl.*
electrica, King.*
hyalina, Schfs.*

**Bryaxis** laticlava, Schfs.
    melanocephala, Schfs.
    picta, Schfs.
        *var.* aethiops, Schfs.
        *var.* ebenifer, Schfs.
        *var.* frontalis Schfs.
        *var.* verticalis, Schfs.
    sobrina, Schfs.
    strigicollis, Westw.*
    talpa, Schfs.
    vitrea, Schfs.
**Articeros** curvicornis, Westw.*

### SILPHIDÆ.

**Ptomaphila** lachrymosa, Schreib.*
**Choleva** antipodum, Blackb.*
    australis, Er.*
Anisotoma Tasmaniæ, Oll.

### TRICHOPTERYGIDÆ.

Ptilium Simsoni, Matth.

### SCAPHIDIDÆ.

**Scaphidium** 4 pustulatum, Oliv.*
Scaphisoma novicum, Blackb.*

### HISTERIDÆ.

Apobletes errans, Mars.
Platysoma læve, Mars.
    latisternum, Mars.
Teretrius Walkeri, Lewis.
Teretriosoma Melbournium, Mars.*
    Somerseti, Mars.*
Acritus Tasmaniæ, Lewis.
Saprinus australis, Boi.*
    laetus, Er.*
Gnathoncus incisus, Er.

### PHALACRIDÆ.

Litochrus brunneus, Er.
Olibrus Victoriensis, Blackb.*
Phalacrus corruscans, Payk.*†

### NITIDULIDÆ.

**Brachypeplus** basalis, Er.*
    blandus, Murray.*
    planus, Er.*

Carpophilus aterrimus, Macl.*
    frivolus, Murray.*
    hemipterus, Steph.*†
Stauroglossicus terminalis, Murray.*
Omosita colon, Linn.*†
Haptoncura Victoriensis, Blackb.*
Circopes pilistriatus, Macl.*
Ericmodes australis, Grouv.*
Pria rubicunda, Macl.*

### Trogositidæ.

Egolia variegata, Er.
Tenebriodes mauritanicus, Linn.*†
Leperina decorata, Er.*
Phycosecis algarum, Pasc.*

### Colydidæ.

Sparactus interruptus, Er.*
    pustulosus, Blackb.
Ditoma pulchra Black.*
    serricollis, Pasc.*
Meryx aequalis, Blackb.*
    rugosa, Latr.*
Deretaphrus Bakewelli, Pasc.*
    granulipennis, Reitter.*
Bothrideres taeniatus, Pasc.*
    vittatus, Newm.*
Penthelispa fuliginosa, Er.*

### Cucujidæ.

Ancistria retusa, Fab.*
Prostomis Atkinsoni, Wath.*
    cornutus, Wath.*
Bessaphilus cephalotes, Wath.
Ipsaphes maerosus, Pasc.*
Platisus angusticollis, Reitter.*
    obscurus, Er.*
Læmophlæus bistriatus, Grouv.*
    Tasmanicus, Grouv.
    testaceus, Fab.*†
Dendrophagus australis, Er.*
Hyliota australis, Er.*
    bicolor, Arrow.*
    lucia, Pasc.*
    militaris, Er.*

**Cryptamorpha** Olliffi, Blackb.*
optata, Oll.
triguttata, Wath.*
**Silvanus** brevicornis, Er.
Surinamensis, Linn.*†
unidentatus, Fab.*†
**Myrabolia** Grouvelliana, Reitter.*

### CRYPTOPHAGIDÆ.

**Cryptophagus** gibbipennis, Blackb.*

### LATHRIDIIDÆ.

**Lathridius** apicalis, Blackb.*
costatipennis, Blackb.*
costatus, Er.*
nigromaculatus, Blackb.*
nodifer, Westw.*†
satelles, Blackb.*
semicostatus, Blackb.*
**Corticaria** Adelaidæ, Blackb.*
australis, Blackb.*

### MYCETOPHAGIDÆ.

**Triphyllus** intricatus, Blackb.*
multiguttatus, Lea.*

### DERMESTIDÆ.

**Dermestes** cadaverinus, Fab.*†
lardarius, Linn.*†
vulpinus, Fab.*†
**Megatoma** morio, Er.
tenuifasciata, Reitt.
**Cryptorrhopalum** Erichsoni, Reitt.*
**Thaumaglossa** concavifrons, Reitt.
**Trogoderma** riguum, Er.
**Anthrenus** varius, Fab.*†

### BYRRHIDÆ.

**Microchaetes** scoparius, Er.*
**Limnichus** australis, Er.
**Aspidophorus** humeralis, Blackb.*

### PARNIDÆ.

**Elmis** Tasmanicus, Blackb.

### LUCANIDÆ.

**Lamprima** rutilans, Er.*
**Lissotus** cancroides, Fab.
curvicornis, Boi.
forcipula, Westw.
Launcestoni, Westw.
latidens, Westw.
obtusatus, Westw.
opacus, Parry.
subcrenatus, Westw.
subtuberculatus, Westw.
**Hoplogonus** Simsoni, Parry.
**Syndesus** cornutus, Fab.*
**Ceratognathus** niger, Westw.*
Westwoodi, Thoms.*
**Mastochilus** dilatatus, Dalm.*

### SCARABÆIDÆ.

**Onthophagus** anisocerus, Er.
auritus, Er.*
australis, Guer.*
evanidus, Har.
fuliginosus, Er.
mutatus, Har.*
posticus, Er.*
pronus, Er.*
**Proctophanes** sculptus, Hope.*
**Phycochus** graniceps, Broun.
(occurs also in New Zealand).
**Aphodius** erosus, Er.
Howitti, Hope.*
Tasmaniæ, Hope.
**Ataenius** Frenchi, Blackb.*
mendax, Blackb.*
**Bolboceras** Kirbyi, Westw.*
proboscideus, Schreib.*
**Trox** Australasiæ, Er.*
**Phyllotocus** assimilis, Macl.*
bimaculatus, Er.
Lottoni, Boi.
Macleayi, Fisch.*
rufipennis, Boi.*
**Diphucephala** colaspidoides, Gyll.*
**Mæchidius** corrosus, Wath.
**Xylonychus** nigrescens, Blanch.
piliger, Blanch.

Liparetrus atratus, Burm.
basalis, Blanch.
concolor, Er.
discipennis, Guer.*
pruinosus, Burm.
salebrosus, Macl.*
ubiquitosus, Macl.*
vestitus, Blanch.
Automolus angustulus, Burm.
Scitala geminata, Boi.*
nigrolineata, Boi.*
sericans, Er.
Colpocheila obesa, Boi.*
Haplonycha scutalis, Blanch.*
Heteronyx australis, Guer.
dimidiatus, Er.
diversipes, Blackb.
fumatus, Er.
glabratus, Er.
jubatus, Blackb.*
nigellus, Er.
ovatus, Blanch.*
præcox, Er.
striatipennis, Blanch.
tempestivus, Er.
unicolor, Blanch.
Caulobius pubescens, Er.
rufescens, Blanch.
Telura vitticollis, Er.*
Nepytis russula, Er.
Rhizotrogus Tasmanicus, Burm.
Anoplognathus suturalis, Boi.*
Saulostomus villosus, Wath.*
Cheiroplatys maelius, Er.
Pimelopus porcellus Er.
Pseudopimelopus Lindi. Blackb.*
Cryptodus anthracinus, Er.
Tasmanius, Westw.
Microvalgus Lapeyrousei, G. & P.*

### BUPRESTIDÆ.

Cyria imperialis, Don.*
Chalcophora albivittis, Hope.*
Nascio carissima, Wath.*
Parryi, Hope.*

**Melobasis** gloriosa, L. & G.*
hypocrita, Er.
intricata, Blackb.
monticola, Blackb.*
nervosa, Boi.*
prisca, Er.
simplex, Germ.*
splendida, Don.*
**Conognatha** navarchis, Thoms.
**Stigmodera** Australasiæ, L. & G.*
Bremei, Hope.*
erythromelas, Boi.
insularis, Blackb.
jubata, Blackb.
Mitchelli, Hope.*
ocelligera, L. & G.
rufipennis, Kirby.*
Thomsoni, Saund.*
undulata, Don.*
virginea, Er.
Wilsoni, Saund.*
**Cisseis** cupreicollis, Hope.*
maculata, L. & G.*
**Neospades** Westwoodi, L. & G.
**Discoderes** Tasmanicus, Germ.
**Agrilus** hypoleucus, L. & G.*

### TRIXAGIDÆ.

**Aulonothroscus** elongatus, Bonv.*

### EUCNEMIDÆ.

**Phœnocerus** subclavatus, Bonv.
**Galbodema** Mannerheimi, Cast.

### ELATERIDÆ.

**Lacon** caliginosus, Guer.*
guttatus, Cand.*
humilis, Er.
pictipennis, Cand.*
variabilis, Cand.*
Victoriæ, Cand.*
**Glyphochilus** furvus, Er.
lucidus, Er.
Tasmanicus, Cand.

**Monocrepidius** Australasiæ, Boi.*
cerdo, Er.*
Cordieri, L. & G.*
coxalis, Cand.
fabrilis, Er.*
fuscicornis, Er.
rutilicornis, Er.
tabidus, Er.
viduus, Cand.
**Elater** perplexus, Cand.*
**Horistonotus** humilis, Cand.
**Corymbites** Tasmanicus, Cand.
**Chrosis** trisulcata, Er.
**Crepidomenus** decoratus, Er.*
fulgidus, Er.
tæniatus, Er.
**Anilicus** 4 guttatus, Er.
Acroniopus humilis, Er.
infimus, Er.

### RHIPIDOCERIDÆ.

**Rhipidocera** femoralis, Kirby.*

### DASCILLIDÆ.

**Helodes** Atkinsoni, Wath.
australis, Er.
maculatus, Wath.
**Macrohelodes** Tasmanicus, Blackb.

### MALACODERMIDÆ.

Metriorrhynchus atratus, Fab.*
erythropterus, Er.*
hæmorrhoidalis, Wath.*
insignipennis, Blackb.
marginatus, Er.
rufipennis, Fab.*
salebrosus, Wath.*
Trichalus discoideus, Er.
Calopteron Goryi, Le G.
Eros scutellaris, Er.
Telephorus nobilitatus, Er.*
pulchellus, Macl.*
tricolor, Cast.*
Selenurus tricolor, Lea.*
Hypattalus abdominalis, Er.
Dasytes fuscipennis, Hope.*

### CLERIDÆ.

Cylidrus basalis, Macl.*
centralis, Pasc.*
nigrinus, White.*
**Tillus hilaris, White.**
**Opilo 6 notatus, Westw.**
*var.* **pulcher, White.**
**Thanasimus accinctus, Newm.***
Natalis cribricollis, Spin.*
porcata, Fab.*
Aulicus corallipes, Chev.
instabilis, Newm.*
**Tarsotenus zonatus, Blanch.***
**Eburiphora patricia, Klug.**
Eleale intricata, Klug.
lanata, Chev.
simplex, Newm.*
speculum, Chev.
Tasmaniæ, Chev.
Lemidia hilaris, Newm.*
malthinus, Newm.
nitens, Newm.*
pictipes, Blackb.*
pulchella, Blackb.*
simulans, Blackb.*
subænea, Gorh.*
Tasmaniæ, White.
Tenerus abbreviatus, White.*
Pylus fatuus, Newm.*
Paratillus carus, Newm.*
Necrobia pinguis, Westw.
ruficollis, Fab.*†
rufipes, De Geer.*†

### LYMEXYLONIDÆ.

Lymexylon australe, Er.
Atractocerus Victoriensis, Blackb.*

### CUPESIDÆ.

Cupes varians, Lea.*

### PTINIDÆ.

Ptinus exulans, Er.*
fur, Linn.*†
tectus, Boield.*†
Anobium domesticum, Linn.*†
paniceum, Linn.*†

### CIOIDÆ.

Lyctus brunneus, Steph.*†
costatus, Blackb.
Cis munitus, Blackb.

### BOSTRYCHIDÆ.

Xylodoleis obsipa, Germ.*
Xylion cylindricus, Macl.*
collaris, Er.*
Xylopsocus gibbicollis, Macl.*
elongatula, Macl.*
Leai, Lesne.
Xylopsocus gibbicollis, Macl.*

### TENEBRIONIDÆ.

Cotulades fascicularis, Pasc.
Docalis funerosa, Hope.
Prionotus serricollis, Hope.*
Edylius canescens, Champ.
Scymena amphilia, Pasc.*
Sphargeris physodes, Pasc.*
Cestrinus aversus, Pasc.*
obscurus, Er.
punctatissimus, Pasc.
trivialis, Er.*
Ecripsis pubescens, Pasc.
Dipsaconia australis, Hope.*
Ulodes verrucosus, Er.*
Caanthus gibbicollis, Champ.
Latometus pubescens, Er.
Elascus crassicornis, Pasc.*
lunatus, Pasc.*
Ganyme sapphira, Newm.*
Ennebæus australis, Champ.
ovalis, Wath.
Enneboeopsis pruinosus, Champ.
Lyphia Tasmanica, Champ.
Platydema limacoides, Pasc.*
tetraspilota, Hope.*
Tribolium ferrugineum, Fab.*†
Paratoxicum iridescens, Champ.
Uloma ovalis, Perr.
Alphitobius mauritanicus, Luc.*†
Toxicum punctipenne, Pasc.*
Pterohelæus Guerini, Breme.
Reichei, Breme.*

Saragus infelix, Pasc.
  laevicollis, Oliv.*
  peltatus, Er.*
Promethis angulata, Er.*
Menephilus colydioides, Er.*
  corvinus, Er.*
  humilis, Er.
  longipennis, Hope.*
  ruficornis, Champ.
Meneristes australis, Boi.*
  servulus, Pasc.*
Tenebrio obscurus, Linn.*†
Tanylypa morio, Pasc.
Decialma Erichsoni, Champ.
Chartopteryx nitida, Er.
Lepispilus sulcicollis, Boi.*
Titæna alcyonea, Er.*
  columbina, Er.*
  Tasmanica, Champ.
Melytra ovata, Pasc.
Hymæa succinifera, Pasc.
Adelium abbreviatum, Boi.
  commodum, Pasc.*
  elongatum, Er.
  latum, Pasc.*
  licinoides, Kirby.
  neophyta, Pasc.*
  nodulosum, Champ.
  obesum, Pasc.*
  porcatum, Fab.*
  Tasmanicum, Champ.
  tenebrioides, Er.
Seirotrana catenulata, Boi.*
Brycopia tuberculifera, Champ.
Dinoria cælioides, Pasc.*
  picta, Pasc.
Coripera deplanata, Boi.
Licinoma pallipes, Blackb.*
Phænnis fasciculata, Champ.
Chalcopterus Howitti, Pasc.*
  iridicolor, Bless.*

### Cistelidæ.

Pseudocistela ovalis, Blackb.*
Licymnius bicolor, Blackb.*
Chromomea nigriceps, Champ.

Nypsius æneopiceus, Champ.
foveatus, Champ.
Apellatus Tasmanicus, Champ.
Allecula luctuosa, Champ.
Homotrysis bicolor, Champ.
Nocar latus, Blackb.*

### PYTHIDÆ.

Lissodema hybridum, Er.*
Notosalpingus ornatus, Blackb.*

### MELANDRYIDÆ.

Dircœa velutina, Champ.
venusta, Champ.
Talayra elongata, Macl.*
Ctenoplectron agile, Champ.*
Orchesia austrina, Champ.*
Mystes planatus, Champ.*
Trichosalpingus fumatus, Champ.*
Lagrioida australis, Champ.*
Scraptia australis, Champ.
laticollis, Champ.
punctatissima, Champ.

### LAGRIIDÆ.

Lagria grandis, Gyll.*

### XYLOPHILIDÆ.

Xylophilus impressicollis, Lea.*
inconspicuus, Blackb.*
pectinicornis, Champ.

### ANTHICIDÆ.

Tomoderus vinctus, Er.
Anthicus australis, King.*
brevicollis, King.*
floralis, Linn.*†
glaber, King.*
Mastersi, Macl.*
rarus, King.*
strictus, Er.*
Tasmanicus, Champ.
Formicomus Denisoni, King.*

### MORDELLIDÆ.

**Mordella** albosparsa, Gemm.*
bella, Wath.*
communis, Wath.*
felix, Wath.
fulvonotata, Champ.*
graphiptera, Champ.*
humeralis, Wath.*
leucosticta, Germ.*
parva, Champ.
promiscua, Er.
pygmæa, Champ
ruficollis, Wath.*
tristis, Lea.*
trivialis, Wath.*
Waterhousei, Champ.*
**Mordellistena** jucunda, Champ.*

### RHIPIDOPHORIDÆ.

**Nephrites** nitidus, Shuck.
**Rhipidius** pectinicornis, Thunb.*†

### CANTHARIDÆ.

**Zonitis** cyanipennis, Pasc.*
tricolor, Le G.*
**Sitarida** minor, Champ.

### ŒDEMERIDÆ.

**Copidita** Macleayi, Champ.*
nigronotata, Boh.*
punctum, Macl.*
**Nacerdes** melanura, Linn.*†
**Asclera** Atkinsoni, Wath.*
sublineata, Wath.*
**Dohrnia** miranda, Newm.*
simplex, Champ.
**Pseudolychus** cinctus, Guer.*
hæmorrhoidalis, Fab.*
**Techmessa** ruficollis, Champ.

### CURCULIONIDÆ.

**Rhadinosomus** Lacordairei *var.* Tasmanicus, Blackb.
**Prostomus** scutellaris, Fab.*
**Euthyphasis** acuta, Pasc.
**Maleuterpes** spinipes, Blackb.*

Otiorhynchus scabrosus, Marsh.*†
sulcatus, Fab.*†
**Merimnetes** oblongus, Blanch.
**Leptops** tribulus, Fab.*
**Amisallus** nodosus, Er.*
**Ethemaia** sellata, Pasc.*
**Psalidura** impressa, Boi.
**Talaurinus** exasperatus, Er.*
penicillatus, Macl.
**Sclerorrhinus** bubalus, Oliv.
tristis, Boi.
**Tetralophus** sculpturatus, Wath.*
**Mandalotus** crudus, Er.
hoplostethus, Pasc.
sterilis, Er.
**Steriphus** solidus, Er.
**Perperus** insularis, Boh.*
languidus, Er.
**Methypora** postica, Pasc.*
**Oxyops** fasciata, Boi.*
**Pantoreites** illuminatus, Lea.
**Syarbis** alcyone, Lea.
**Gonipterus** exaratus, Fahrs.*
scutellatus, Gyll.*
turbidus. Pasc.
**Prophæsia** confusa, Pasc.
**Strongylorrhinus** ochraceus, Sch.*
**Aromagis** echinatus, Pasc.*
**Atelicus** abruptus, Pasc.
atrophus, Pasc.
guttatus, Pasc.
inœqualis, Wath.*
**Aterpus** cultratus, Fab.*
rubus, Boh
Pelororrhinus margaritaceus, Er.*
**Rhinaria** costata, Er.*
granulosa, Fahrs.*
perdix, Pasc.*
transversa, Boi.*
**Orthorhinus** aethiops, Boi.*
cylindirostris, Fab.*
Klugi, Boh.*
lepidotus, Er.
**Lixus Mastersi**, Pasc.*
**Aoplocnemis** phaleratus, Er.*
rufipes, Boh.*
Tasmanicus, Blackb.

- Anorthorhinus apicalis, Lea.*
  - pictipes, Blackb.*
- Desiantha maculata,Blackb.*
  - vittata, Blackb.*
- Storeus monticola, Blackb.*
- Encosmia cornuta, Blackb.
- Misophrice parallela, Black.*
  - variabilis, Blackb.*
- Cryptoplus perdix, Er.
- Rhaciodes bicaudatus, Boi.*
  - dentifer, Boh.*
  - granulifer, Chev.*
  - multidentatus, Chev.
- Meriphus fullo, Er.*
- Eristus setosus, Blackb.*
- Myositta cirrifera, Pasc.*
- Belus bidentatus, Don.*
  - bimaculatus, Pasc.*
  - filum, Jekel.*
  - Grayi, Jekel.
  - irroratus, Jekel.
  - rubicundus, Lea.*
- Pachyura australis, Hope.*
  - dermestiventris, Boi.*
  - minima, Blackb.*
- Rhinotia hœmoptera, Kirby.*
- Eurhynchus quadridens, Er.
  - quadrinodosus, Er.
- Auletes melaleucæ, Lea.*
  - melanocephalus, Er.
  - suturalis, Wath.*
- Diapelmus mendax, Er.
- Læmosaccus carinicollis, Lea.*
  - ocularis, Pasc.*
  - rufipennis, Lea.*
  - subsignatus, Boh.
- Platyurus brevicornis, Blanch.
- Haplonyx albofasciatus, Chev.
  - fasciculatus, Bohem.*
  - frontalis, Chev.
  - Kirbyi, Fahrs.*
  - mediocinctus, Chev.
  - nigrirostris, Chev.*
  - Spencei, Gyll.*
  - vicinus, Chev.*
- Rhamphus acaciæ, Lea.*

Pseudostoreus placitus, Lea.*
Cyllorhamphus tuberosus, Er.
Melanterius maculatus, Lea.*
    porcatus, Er.*
Poropterus abstersus, Boh.
    antiquus, Boh.
    conifer, Er.*
    satyrus, Pasc. (Gen. Dub.).
    succisus, Er.
    zopherus, Lea.
Microporopterus tumulosus, Pasc.*
Acalles acerosus, Er. (Gen. Dub.).
    rubetra, Er. (Gen. Dub.).
Euthyrrhinus meditabundus, Fab.*
Ephrycus obliquus, Pasc.*
Isax gallinago, Pasc.*
Achopera lachrymosa, Pasc.*
Tychreus camelus, Pasc.
Exithius capucinus, Pasc.
    cariosus, Er.
    morbillosus, Pasc.
    musculus, Pasc.
Cryptorrhynchus antares, Er. (Gen. Dub.).
    infulatus, Er. (Gen. Dub.).
    sirius, Er. (Gen. Dub.).
    solidus, Er. (Gen. Dub.).
Ampagia femoralis, Er.
Tyrtæosus ustulatus, Pasc.*
Aphela algarum, Pasc.*
Pentarthrum nigrum, Woll.
Pentamimus canaliculatus, Woll.
Cossonus præustus, Redt.*
Tasmanica myrmecophila, Lea.
Rhyncolus polixus, Er. (Gen. Dub.).
    australis, Er (Gen. Dub.).

### Scolytidæ.

Cryphalus pilosellus, Er.
Xyleborus truncatus, Er.*

### Brenthidæ.

Cyphagogus delicatus, Lea.*
Cordus hospes, Germ.*

### ANTHRIBIDÆ.

**Anthribus bispinus, Er.**
Tropideres albuginosus, Er.
musivus, Er.

### BRUCHIDÆ.

Bruchus rufimanus, Boh.*†

### CERAMBYCIDÆ.

Cnemoplites australis, Er.
Toxeutes arcuatus, Fab.*
Enneaphyllus æneipennis, Thoms.
Pœcilus metallicus, Newm.*
Phacodes obscurus, Fab.*
personatus, Er.*
Phoracantha fallax, Pasc.*
quinaria, Newm.*
senio, Newm.*
semipunctata, Fab.*
synonyma, Newm.*
Tryphocharia Mastersi, Pasc.*
superans, Pasc.
Epithora dorsalis, Macl.*
Allotisis unifasciata, Hope.*
Coptocercus rubripes, Boi.*
Sisyrium plagiatum, Gahan.
Acyrusa Tasmanica, Gahan.
Bethelium Blackburni, Gahan.
signiferum, Newm.*
Notoceresium impressiceps, Blackb.
Callidiopis præcox. Er.*
scutellaris, Fab.*
Phlyctaenodes fasciatus, Gahan.
pustulatus, Hope.
pustulosus, Newm.*
tristis, Fab.
Tessaromma sericans, Er.*
undatum, Newm.*
Gracilia pygmaea, Fab.*†
Strongylurus ceresiodes, Pasc.
scutellatus, Hope.
Lygesis mendica, Pasc.*
Uracanthus bivittatus, Newm.*
pallens, Hope.
Rhinopthalmus nasutus, Newm.*
Tritocosmia paradoxa, Pasc.*

Tropis oculifera, Newm.
Pterostenus concolor, Macl.*
suturalis, Oliv.*
Syllitus microps, Blackb.
rectus, Newm.*
Macrones acicularis, Pasc.*
exilis, Newm.*
Enchoptera apicalis, Saund.
Brachopsis concolor, Saund.
Pseudocephalus arietinus, Newm.
Zoedia divisa, Pasc.*
triangularis, Pasc.*
V-album, Boi.
Earinus mimula, Pasc.*
Mecynopus cothurnatus, Er.
Hesthesis cingulata, Kirby.*
Distichocera par, Newm.*
Pytheus latebrosus, Newm.*
Brachytria gulosa, Newm.*
Omophæna tæniata, Pasc.*
Ochyra coarctata, Pasc.
Homæmota Walkeri, Gahan.
Amphirhoe decora, Newm.*
Tragocerus Spencei, Hope.*
Dorcadida biocularis, White.
Walkeri, Gahan.
Microtragus luctuosus, Shuck.
Zygocera cænosa, Er.*
lugubris, Pasc.*
Probatodes piliger, Macl.*
Ancita crocogaster, Boi.*
marginicollis, Boi.*
sparsa, Pasc.*
Rhytiphora Simsoni, Blackb.
Acanthocinus plumula, Newm.
Pentacosmia scoparia, Newm.*
Illæna exilis, Er.

### CHRYSOMELIDÆ.

Microdonacia incerta, Blackb.*
Ditropidus lentulus, Chp.*
ochropus, Er.
ruficollis, Saund.
rufipes, Saund.
subæneus, Chp.
Lachnabothra Saundersi, Baly.*

**Cadmus** australis, Boi.*
cognatus, Saund.*
crucicollis, Boi.*
dorsalis *var.* Ewingi, Saund.*
ferrugineus, Fairm.*
pacificus, Suff.*
rufescens, Saund.*
strigillatus, Chp.*
Tasmanicus, Saund.
**Cryptocephalus** albilinea, Saund.*
apicalis, Saund.*
ater, Saund.*
consors, Boi.*
erosus, Saund.*
hæmatodes, Boi.*
Jacksoni, Guer.*
rufescens, Saund.*
subfasciatus, Saund.*
*var.* melanocephalus, Saund.
vermicularis, Saund.*
viridipennis, Saund.*
viridis, Saund.*
**Loxopleurus** Tasmanicus, Saund.*
**Noda** Tasmanica, Jac.
**Agetinus** jugularis, Er.
**Tomyris** elegantula, Laf.
proxima, Er.
viridula, Er.
**Phyllocharis** cyanicornis, Fab.*
**Chalcolampra** ænea, Boi.*
constricta, Er.*
luteicornis, Er.
pacifica, Er.
thoracica, Baly.*
**Calomela** Curtisi, Kirby.*
maculicollis. Boi.*
**Paropsis** agricola, Chp.
atomaria, Oliv.*
aurea, Blackb.
bimaculata, Oliv.*
Calliope, Blackb.
comma, Blackb.
decolorata, Chp.*
delicatula, Chp.*
ferrugata, Chp.
hamadryas, Stal.*
*var.* flavitarsis, Chp.

Paropsis hectica, Boi.*
hera, Stal.
lachesis, Stal.*
laesa, Germ.*
lepida, Er.
lignea, Er.
lineata, Marsh.*
lutea, Marsh.*
morio, Fab.*
nobilitata, Er.
nucea, Er.
obliterata, Er.
obovata, Chp.*
orphana, Er.
papulenta, Chp.
papulosa, Er.
picea, Oliv.*
porosa, Er.*
reticulata, Marsh.*
rufipes, Fab.*
rugosa, Chp.*
serpiginosa, Er.
Simsoni, Blackb.
subcostata, Chp.
subfasciata *var.* planior, Blackb.
Tasmanica, Baly.
trimaculata, Chap.*
umbrosa, Chp.*
variicollis, Chp.*
venusta, Er.
**Arsipoda** bifrons, Er.
Erichsoni, Baly.
variegata, Wath.
**Graptodera** corrusca, Er.
**Haltica** australis, Blackb.*
ignea, Blackb.*
pagana, Blackb.*
**Chætocnema** Erichsoni, Baly.
**Psylliodes** chlorophana, Er.
**Ellopia** pedestris, Er.*
**Monolepta** alpina, Blackb.*
nigricornis, Blackb.*
subsuturalis, Blackb.*
**Euryspa** vittata, Baly.*
**Monochirus** fimbriatus, Chp.

### EROTYLIDÆ.

**Thallis** compta, Er.*
femoralis, Blackb.
janthina, Er.*
vinula, Er.*
**Episcaphula** australis, Boi.*

### ENDOMYCHIDÆ.

**Daulis** cimicoides, Er.

### COCCINELLIDÆ.

**Leis** conformis, Boi.*
**Coccinella** transversalis, Fab.*
**Halyzia** Mellyi, Muls.*
**Alesia** frenata, Er.*
**Orcus** Australasiæ, Boi.*
bilunulatus, Boi.*
**Novius** cardinalis, Muls.*
**Rhizobius** alphabeticus, Lea.*
Boucardi, Crotch.*
calomeloides, Lea.
discolor, Er.*
hirtellus, Crotch.*
Lindi, Blackb.*
pulcher, Blackb.*
tricolor, Lea.
ventralis, Er.*
virgatus, Lea.
**Scymnus** flavifrons, Blackb.*
trilobus, Lea.
vagans, Blackb.*
**Pharus** strangulatus, Er.
**Bucolus** obscurus, Lea.
**Serangium** nigrum, Lea.
**Cycloscymnus** minutus, Blackb.*
**Epilachna** Tasmanica, Crotch
11 variolata, Boi.

### CORYLOPHIDÆ.

**Corylophus** fasciatus, Er.
thoracicus, Er.

# NDITIONS UPON WHICH THE HEALTHY GROWTH OF THE POPULATION OF YOUNG COLONIES DEPEND.

BY R. M. JOHNSTON, F.S.S.

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(Read 14th July, 1903).

a great pleasure to me to listen to
aper written by Mr Green, for
er subject engages his attention is
have been studied with more than
y care, and his conclusions are such
must always entertain them with
atest respect, even when we may
me difficulty in adopting them in
ntirety. While dwelling upon the
future possibilities of this particu-
avored portion of the Common-
as regards climate, soil, and other
advantages, in all of which
rations I am heartily in accord
him, I was (as regards the
iate attractions to immigrants
ss-favored centres of far distant,
-populated countries) pleased to
his caution as to the class of
rants that should be specially
aged to make a home in our
He has carefully shown
“ it is not wise to indiscrimi-
invite all sorts of people to
o Tasmania, or to any other parts
world.” . . “ Experience gained
e communities may be of value,
ore launching out in a new country
bsolutely essential to obtain a
dge of local conditions.” Among
nditions, as regards the intending
upon the land, he mentions the
ty of paying special attention to
erences in soil and climate. He
very wisely observes that: “ It is
ted that the prosperity of new
ies must depend largely upon agri-
, especially upon what are termed small industries—industries where profits are derived from the economical working of the soil, and which enables large families to live comfortably on small acreages.” These conclusions of Mr Green are strongly borne out by facts and figures which have come under my own observation. While I am in perfect agreement with Mr Green in the belief that it is very desirable to encourage immigration, and that this favored little colony, although by far the smallest member of the Australian Commonwealth is capable of sustaining in comfort a population of twelve times its present number, still great caution must be exercised as to the character and the numbers of immigrants introduced at any one point of time. It is true the United States of America receives yearly a stream of immigrants from the crowded centres of Europe of over 400,000, without much disturbance to the natural proportions of its various divisions of occupations. But even the 487,918 immigrants absorbed by her in the year 1901 only represents 0.64 per cent of her enormous population of 76 millions, aud only represents 14 persons added to every 100 square miles of her territory. It is of interest also at the present time to note the curious composition of this important yearly stream of immigrants absorbed by the United States The following table shows the origin of the 487,918 immigrants from European countries in the order of their relative importance as regards numbers:—

IMMIGRATION INTO THE UNITED STATES (1901),

| Country of Origin. | No. | Per cent. |
|---|---|---|
| Italy ... ... | 135,996 | 27.37 |
| Austria-Hungary ... | 113,390 | 23.24 |
| Russia ... ... | 85,257 | 17.47 |
| British Isles ... | 45,564 | 9.34 |
| Sweden, Norway, and Denmark ... | 39,234 | 8.04 |
| Germany ... ... | 21,651 | 4.44 |
| France ... ... | 3,150 | 0.65 |
| Others ... ... | 43,676 | 8.95 |
| Total ... ... | 487,918 | 100.00 |

Large as this stream appears, its equivalent relative to our present population would only represent an addition of 1132 immigrants yearly. The ability to absorb even this number without congestion of the local labor market would entirely depend upon the class of immigrant introduced. I agree with Mr Green in thinking that unless they were mainly drawn from the agricultural class, the fresh introduction of this number of immigrants yearly to Tasmania would result in congestion of the local labor market. It is a common mistake, also, to imagine that a large population would necessarily improve the condition of the existing breadwinners of Tasmania. It is too commonly overlooked that the individual breadwinner ef a country at the second, or agricultural stage of development, enjoys a much better standard of living than his brother workman in a densely-populated country with its fiercer struggle for existence. Density of population, also involving crowded cities and unhealthy occupations, would banish, too, the high standard of health which the people in these thinly-populated lands now enjoy. The greatness of either the aggregate wealth of a country, or the greatness of the aggregate population affords no information as to the individual wealth or material well-being of its people; and although in these young colonies of Australasia the rapidity with which they have increased their respective populations may be fairly taken as a good index of a corresponding improvement in the social and material well-being of the people generally, it does not follow that the greatness of a country's aggregate population affords the slightest indication as to the standard of living or the material well-being of the individuals of which the aggregate is composed. The best index of the relative prosperity of the people of different countries, no matter what the aggregate number of the population may be, is the individual purchasing power as indicated by the average "cost of living" and the "ratio of cost of food to earnings," as in the following table, according to the eminent statistician Mulhall. The figures for Australasia have been determined by my distinguished friend, Mr Coghlan.

COST OF FOOD AND BEVERAGE IN RELATION TO EARNINGS AND EFFORT AS INDICATED BY THE AVERAGE DAY'S EARNINGS.

| Country. | Average annual cost of food and beverage. | | | Ratio of cost of food to earnings. | Days' earnings equal to annual cost of food. |
|---|---|---|---|---|---|
| | £ | s | d | Per Cent. | Days. |
| United Kingdom | 14 | 4 | 9 | 42.2 | 127 |
| France ... ... | 12 | 4 | 5 | 44.0 | 142 |
| Germany ... | 10 | 18 | 5 | 49.1 | 148 |
| Russia ... ... | 5 | 19 | 7 | 52.0 | 156 |
| Austria ... ... | 7 | 17 | 4 | 50.8 | 152 |
| Italy ... ... | 6 | 4 | 10 | 51.2 | 158 |
| Spain ... ... | 8 | 9 | 0 | 51.2 | 154 |
| Portugal... ... | 7 | 3 | 0 | 59.1 | 177 |
| Sweden ... ... | 9 | 18 | 11 | 45.2 | 136 |
| Belgium... ... | 12 | 3 | 1 | 43.4 | 130 |
| United States ... | 9 | 17 | 7 | 25.3 | 76 |
| Canada ... ... | 8 | 9 | 0 | 32.5 | 97 |
| Australasia ... | 15 | 15 | 7 | 37.5 | 112 |

The above table shows that the condition of the colonies of Australasia compares very favorably with most of the countries for which particulars are given. It also shows that while the cost of food and drink is £15 15s 7d per head in Australasia against £14 4s 9d in the United Kingdom, the proportion of earnings required to pay for this food and the equivalent in days' earnings are much less: that is the purchasing power of the average person in Australasia is greater. This favorable position it also maintains as compared with all countries, with the exception of the United States and da. Even as compared with the , the condition of the average pers shown to be, if anything, superior, take also into consideration the tity and quality of the food cond as shown in the following sum- :—

### JMPTION OF PARTICULAR KINDS OF FOOD PER INHABITANT (LBS).

| Country | | Grain | Meat | Sugar | Potatoes | Tea and Coffee—oz | Butter and Cheese |
|---|---|---|---|---|---|---|---|
| ... | ... | 378 | 109 | 75 | 380 | 91 | 19 |
| d States | ... | 370 | 150 | 58 | 170 | 162 | 20 |
| da | ... | 400 | 90 | 45 | 600 | 72 | 22 |
| alasia | ... | 392 | 264 | 100 | 266 | 126 | 19 |
| ania | ... | 472 | 245 | 85 | 495 | 113 | 16 |

### TIONS UPON WHICH PROGRESS IN YOUNG COLONIES DEPENDS.

hough much depends upon the m and energy of men in framing laws and promoting industries, the opmental progress of young colonies ds, in a greater measure than is gene- understood, upon the extent and the al conditions of the lands open to ising efforts. The whole fabric of the r stages of a colony depends entirely e agricultural, pastoral, mineral, and primary industries directly engaged aining the raw or staple products tial to the life of man, viz., food, ng, shelter, warmth, and other com- Successful enterprise in these ry industries, again, depends largely the extent of the natural facilities d in the various lands open for ion to immigrants from other ly-populated centres. Among the pal factors which determine the ess of settlement in the earlier stages olony's history are climate, suita- of soil for agricultural or pastoral its, and nearness of producing s to market or seaboard. first the better lands or naturally open or accessible attract the attention of settlers; e rate of settlement in each colony y diminishes as the poorer or less ible areas are approached. Thus in the earlier stages, the smaller areas open to settlers in Tasmania and Victoria show a much more rapid development, owing to their greater accessibility, more favorable climate, and, comparatively, more fertile soils attracting a larger proportion of the stream of enterprising immigrants from European centres. The very much greater rate of settlement, however, is soon checked by the limited areas of the smaller colonies, and henceforward the major stream of immigration gradually diverges to the less favorable climate and the second class pastoral lands of the larger colonies, as shown in the later more rapid development of the larger, naturally open, areas of New South Wales and Queensland. Broadly speaking, therefore, the development of a new colony passes, naturally, through three great successive predominating stages, partly overlapping, viz.: (1) The predominance of the pastoral stage. (2) The predominance of the agricultural stage. (3) The predominance of the manufacturing stage, as in England, Scotland, and Belgium. The last of these stages is a long way off so far as the Australasian Colonies are concerned, because density of population —involving a greater struggle for existence among the laboring classes—is essential to the establishment of great manufacturing industries which can successfully and independently compete with other countries in the external or open markets of the world. But pastoral and agricultural interests alone cannot support many persons to the square mile of territory, and hence, in young colonies, the rate of development, so far as population is concerned, is usually less rapid when all the more available and accessible lands have been encroached upon, and when the third or manufacturing stage is approached. The following table, prepared more recently, shows clearly in a general way the proportions of the different classes of breadwinners accordingly as the State or country has arrived at the second and third developmental stages—that is, the agricultural and manufacturing stages. Tasmania and New Zealand are chosen to illustrate the conditions of the second or agricultural stage, and England is chosen to illustrate the conditions of the third or manufacturing stage:—

PROPORTION PERCENTAGE OF BREADWINNERS EMPLOYED IN DIFFERENT OCCUPATIONS (GAINFUL) ACCORDINGLY AS THE COUNTRIES COMPARED REPRESENT THE TWO GREAT STAGES OF INDUSTRIAL DEVELOPMENT.

PERCENTAGE BREADWINNERS.

| | Second Stage (Agricultural). | | Third Stage (Manufacturing). | | |
|---|---|---|---|---|---|
| | Tasmania. per cent. 1901. | New Zealand. per cent. 1896. | Queensland. per cent. 1901. | England. per cent. 1891. | United States. per cent. 1890. |
| Agricultural and other Primary Industries | 37·95 | 35·26 | 38·15 | 10·39 | 39·65 |
| Other Occupations— | | | | | |
| Industrial... ... ... ... ... | 25·53 | 27·93 | 23·30 | 56·84 | 22·39 |
| Commercial and Transport ... ... | 15·62 | 17·20 | 20·13 | 10·86 | 14·63 |
| Domestic ... ... ... ... ... | 10·80 | 9·64 | 11·36 | 14·73 | 19·18 |
| Professional ... ... ... ... | 6·80 | 6·23 | 6·19 | 7·18 | 4·15 |
| Indefinite ... ... ... ... ... | 2·13 | 2·24 | 0·87 | — | — |
| Total Other Occupations ... ... ... | 62·05 | 64·74 | 61 85 | 89·61 | 60·35 |
| All ... ... ... ... ... ... | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 |
| Density of Population per square mile ... | 6·65 | 7·74 | ·62 | 536·00 | 21·70 |

So far as countries at the second or agricultural stage are concerned, it is important to bear in mind that the numbers engaged in the primary industries determine very rigidly the number of persons that may be employed with advantage in any other form of occupation. At this stage, therefore, the latter may well be termed the dependent occupations. The proportions shown indicate that in Tasmania the natural conditions are such that for every 10,000 persons employed in any occupation there must be 8795 of them engaged in one or other of the agricultural, mining, and other primary industries. In other words, every 1000 persons engaged directly in the primary industries in Tasmania makes it possible for 1684 persons, and no more, to find room for employment in some other useful occupation; and that for every 1000 persons you can place as breadwinners upon the land, you can economically support an additional population of 6182 souls. It is largely due to the flooding of particular kinds of employment beyond the strict proportions which local wants demand that inconvenience or distress is felt in young as well as in old countries. The numbers which can find entry into the "dependent," industrial, commercial, and professional divisions cannot, without unhealthy competition, be increased beyond the relative proportions which these divisions must bear to the primary producing industries of the particular country; and these dominating industries in Australasia are agricultural, pastoral, and mining. Employment in other divisions can only follow substantial increases in the primary industries; for manufacturing industries cannot alter their present proportions independently, as in England, until such time as they are able to successfully manufacture for the external or world's markets. This applies much more strongly to the smaller division represented by unskilled labor (not agricultural or primary), and to the commercial and professional classes. These certainly may only increase according to their more or less rigid economic proportions; and, as already stated, this again must be determined by a previous increase in the fundamental producing industries of the place.

incipal producing industries of the
may increase irrespective of other
ivisions, as their products – agricul-
pastoral, and mining—may find
r enough the necessary purchasers
eign markets. Whatever influence
ore, may bar the progress of the
ating producing industries of the
must also bar occupations in all
divisions of services.

far as the State of Tasmania is
ned, I am of opinion that the
of annual increase—viz., 1·64 per
per annum—would be the most
ctory base for forming an estimate
population 100 years hence. Not-
anding the favourable and ex-
nal experience of the United States
nerica, which has increased its
tion at the very high annual rate of
er cent during the 100 years ending
ar 1900, and notwithstanding that
ustralasian colonies, as a whole,
sed at the high annual rate of 6·57
nt during the last century—I am of
n it would be altogether improbable
ither Tasmania or the other States
Australian Commonwealth could
ain in the growth of popula-
a higher rate of annual increase
the whole course of the next 100
—than that experienced by Tas-
during the last decade, viz., 1·64
nt per annum. The following are
ain considerations which have guided
arriving at conclusions on this sub-
—The relatively more rapid rate of
h of population in young countries—
ally in the earlier stages of settle-
—is mainly due to the following in-
es : (1) The influx of a continuous
n of immigrants producing, at first,
small population, a much larger
rtion of the annual increase than the
ate major source of increase, viz.,
nual rate of natural increase, or the
of births over deaths. For example,
opulation of say 200,000, an influx
year of 20,000 immigrants would
ent an annual increase of as much
per cent., while the normal natural
se would be above the average if it
nted to 2 per cent., representing only
rease of 4000. At a later stage
the population reached 10,000,000,
lux of 50,000 immigrants in one
would only represent one-half
per cent., while the natural increase of say 2 per cent. would add as much to its population in one year as 200,000. This is the true reason why such abnormal annual rates of increase occur in the earlier decades of the wonderful development of these Australasian colonies, and it explains why the high annual rate of increase of 11·27 per cent. in the decade ending in the year 1861 has gradually fallen until it reached the average of only 1·78 per cent. per annum during the decade ending in the year 1901. The following table further illustrates the fluctuating character of the earlier periods of high rates of increase due to influx of immigrants in young countries, as contrasted with the more normal progress of the United Kingdom with its great density of population, in which the influence of migration on its annual rate of increase is so comparatively small that it may be altogether ignored :—

ANNUAL RATE OF INCREASE OF POPULATION DURING THE LAST CENTURY IN OLD AND YOUNG COUNTRIES COMPARED.

| Decade ending Year | United Kingdom | United States | Canada | Australasia | Tasmania |
|---|---|---|---|---|---|
| 1810-11 | 3·38 | 3·12 | 2·88 | 5·88 | — |
| 1820-21 | 1·59 | 2·90 | 2·88 | 11·94 | — |
| 1830-31 | 1·41 | 2·95 | 0·80 | 8·34 | 16·41 |
| 1840-41 | 1·08 | 2·85 | 6·39 | 10·28 | 6·55 |
| 1850-51 | 0·25 | 3·11 | 0.87 | 7·39 | 3·40 |
| 1860-61 | 0·63 | 3·10 | 5·31 | 11·27 | 2·52 |
| 1870-71 | 0·83 | 2·07 | 1·64 | 4·39 | 1·13 |
| 1880-81 | 1·02 | 2·73 | 1·75 | 3·60 | 1.38 |
| 1890 91 | 0·79 | 2·80 | 1·12 | 3·34 | 2·36 |
| 1900-01 | 0·75 | 1·96 | 1·06 | 1·78 | 1·64 |
| NUMBER OF YEARS REQUIRED TO DOUBLE POPULATION. | | | | | |
| * | 71·80 | 26·62 | 28·64 | 10·89 | 16·35 |
| † | 92·79 | 35·71 | 65·71 | 39·29 | 42·61 |

* Average of the last century (years).

† Average of the last decade (years),

(2.) The preceding table clearly demonstrates not only that the annual rate of increase of population in the younger countries is rapidly approaching the normal rates of the older and more densely-populated centres of population, but also, as regards the latter, there is evidence of another cause in operation during the last decade, having the effect of still lowering the annual rate of increase of the population. From the beginning of the year 1881 the statistics of the United Kingdom and of the Australasian Colonies show, unmistakably, that a great change has taken place as regards the social conditions of the people, and specially affecting the birth-rate in these countries. My friend, Mr Coghlan, the distinguished statistician of New South Wales, has made a special study of this important matter. In his statistical account of "The Seven Colonies of Australasia, 1901-1902" (pp. 502-503) he has made the following important observations: "It is a matter of common knowledge that for some years past the birth-rate in Australasia has been declining, and so important is the subject—not only as regards the growth of population, but also as affecting general progress—that in 1899 the author made a special investigation into the question of childbirth in Australia, but more particularly with reference to New South Wales. The conclusions arrived at with respect to that State, however, may be held to obtain for all the others, seeing the conditions of living do not differ materially in any of them. During the course of the investigation it was found, first, that for all women the proportion of fecund marriages is decreasing; second, that among fecund women the birth-rate is much reduced as compared with what it was twenty years ago. . . It was also found that the decline has been persistent and regular since 1881, and this restriction of births in a young country like Australia, where immigration is discouraged, is a matter which must have far-reaching results although its economic effects are only beginning to be seen, and should claim the serious consideration of all thoughtful people." It is true that the lowering of the birth-rate, at once, to some extent, operates in reducing the general death-rate also: but the serious decline in the rate of natural increase, as shown in the following summary, is a strong additional reason for caution in forming any estimate of the growth of population in these colonies during the next century:—

### BIRTH-RATE, DEATH-RATE AND NATURAL RATE OF INCREASE IN EACH QUINQUENNIUM IN AUSTRALASIA, 1861-1900.

AVERAGE RATE.

| Quinquennium. | | Birth-rate. | Death-rate. | Natural Increase. |
|---|---|---|---|---|
| 1861-65 | ... | 41·92 | 16·75 | 25·17 |
| 1866-70 | ... | 39·84 | 15 62 | 24·22 |
| 1871-75 | ... | 37·34 | 15·26 | 22·08 |
| 1876-80 | ... | 36·38 | 15·04 | 21·34 |
| 1881-85 | ... | 35·21 | 14·79 | 20·42 |
| 1886-90 | ... | 34·43 | 13·95 | 20·48 |
| 1891-95 | ... | 31·55 | 12·76 | 20·79 |
| 1896-1900 | ... | 27·31 | 12·20 | 15·11 |

I have thus given, as briefly as the nature of the subject permits, the reasoning upon which, elsewhere, I have chosen to base my estimate of the growth of population in this State upon the latest rates of annual increase, rather than upon averages, which include the differing conditions of the earlier periods, involving as they do the unreliable disturbing conditions and non-recurring abnormal proportional increases, due to influx of immigrants. It is even doubtful if the lower average rates of increase of the last decade can be maintained over so long a period as the next 100 years; but when we consider that the nearness of the United States of America, with her still vast areas of undeveloped lands open to the surplus population of Europe, her rapidly growing density of population, with the resulting congestion of her labor market, perhaps may favor a diversion of a very much larger proportion of European surplus labor to Australia within the next thirty or forty years. We have, therefore, good reason for the belief that the higher stages of development in the United States, in the coming century, may specially favor the progress of the Australasian group. An estimate prepared by me, based upon the experience of twenty-one great countries, with a population of over 400 millions, demonstrates that the present civilisation requires the cultivation of 2.25 acres per head for food and raw products. The present area of the United States is reckoned at about 2291 million acres. Allowing a need of the estimated requirement of cultivated land, viz., 2.25 acres per head, for supplying the whole round of wants of each person, and that three-fourths of her total

re capable of cultivation; then if
pulation increases at her present
f 1·96 per cent. per year, it would be
t in 119 years (763 million persons)
he produce of every available acre
be wholly required for home con-
tion. The checks to population,
er, may be expected to increase,
is limit may be placed further back;
is clear that the need to withdraw,
and more, her present enormous
of raw products from external
ts will greatly operate in enhancing
lue of the virgin soils of the more
t Australasia, and so give an
onal spur to her development in the
g years.

### BLE GROWTH OF POPULATION IN
### MANIA DURING THE NEXT CENTURY.

ning our attention now to the future,
ssuming that the annual rate of
h of population during the last
(1·64) will be maintained without
aterial change throughout the next
ears, the following table has been
red by me showing the estimated
ation in single years for the first ten,
ereafter in intervals of ten years.
opulation of the Commonwealth is
given for comparison at intervals of ten years. The annual rate assumed by me for the determination of the latter is taken at 1·73 per cent.

### ESTIMATED POPULATION DURING THE NEXT 100 YEARS.

| Year. | Tasmania. | Common-wealth. | Tasmania's Per Cent. Proportion. |
|---|---|---|---|
| 1902 | 177,077 | 3,883,822 | 4.56 |
| 1903 | 179,981 | | |
| 1904 | 182,983 | | |
| 1905 | 185,933 | | |
| 1906 | 188,982 | | |
| 1907 | 192,082 | | |
| 1908 | 195,232 | | |
| 1909 | 198,434 | | |
| 1910 | 201,688 | 4,455,037 | 4.53 |
| 1920 | 237,316 | 5,288,607 | |
| 1930 | 279,238 | 6,278,144 | |
| 1940 | 328,565 | 7,452,832 | |
| 1950 | 386,609 | 8,847,310 | 4.37 |
| 1960 | 454,899 | 10,502,700 | |
| 1970 | 535,256 | 12,467,800 | |
| 1980 | 629,809 | 14,800,610 | |
| 1990 | 741,069 | 17,570,000 | |
| 2000 | 871,971 | 20,857,405 | |
| 2001 | 886,273 | 21,218,208 | |
| 2002 | 900,810 | 21,585,350 | 4.17 |

# "AGRONOMY: IN ITS RELATION TO SCIENCE."

### BY REV. E. H. THOMPSON.

(Read 11th August, 1903)

eference is made to the original and constitution of the Royal , it will be found that it ounded by the members of the nian and Horticultural Societies, n the fourth section it is stated the leading objects of the society nvestigate the physical character of and and to illustrate its natural and productions." I believe I am in saying that the general tenor many papers which, since its initia- 1848, have been read at its meet- ave for the most part had a dis- practical, rather than a theoretical, cy. What I mean is that, except- f course those of a descriptive ter, such as, for instance, those g with the classification or enumer- of species or genera, the subjects with have to a great extent had an ntly practical bearing upon the in- es of the State. This being the nay I presume to suggest that the has arrived when a more direct pt might very well be made to ate research into the very interest- d wide domain of agronomy? It is hat the proceedings of the society n many invaluable papers on s agricultural subjects, but I ven- think that no direct or continuous has been made to pursue system- searches into some of the problems are so intimately associated with ndustrial progress and development. I believe, usual in all societies ed with similar objects to those of yal Society of Tasmania to divide ork of research and investiga- nto various sections, so that those ers who are specially qualified and sted in certain matters may concen- their attention on those particular hes, and therefore be enabled to more deeply and fully into details would be possible in any other way. g as I do the absolute necessity of ning scientific with practical know- I am at once brought face to face with the difficulty, that at the present time there seems to be no machinery in existence, or perhaps I should say, that no machinery has been set in motion which would serve as a channel through which the results of scientific experiments in agronomical theories could be made available to the public, or by which systematic investigations could be carried on. It is obvious that agricultural and horticultural societies do not, and, from the nature of their constitution, cannot enter into the minute and patient study of many matters which nevertheless are likely to have a very practical bearing upon the industries which they represent. It is therefore with this idea that I crave the indulgence of the members of this society while I plead for the formation of a section which would deal with agriculture in all its branches, and especially with those subjects which directly concern its economic and commercial progress. I would point out that at the present time, though there is a large amount of experimental work being carried on, there is practically no record being kept of such discoveries or investigations, and that therefore the State at large gains little or nothing from them. Experiments conducted singly and spasmodically lose much of their value; whereas if submitted to comparison with the labors of others, they assume an importance and interest which would be unattainable in any other way. I do not think that it will be disputed that there are many matters which are at the present time altogether neglected or unnoticed, the better knowledge of which might have a material effect on the industrial and commercial prosperity of the State. May I be allowed to instance a few of them? Taking the branch of agronomical work in which I am personally most interested– that of horticulture—I would call attention to the desirability of establishing some recognised system of nomenclature for our fruits. It must be obvious to everyone that the present confusion is mischievous and misleading. I know that many people imagine that it makes little or no difference whether a fruit is called by different names, and so they make no effort to arrive at any finality in the matter. A little consideration will, however, show that not only is such confusion discreditable to us, in view of the importance of the fruit industry, but that it also results in direct injury to the growers and shippers. I am aware that this fact has been denied and the possible injury questioned. but I have had many proofs of the correctness of my contention. I can recall instances of growers sending the same kind of fruit by the same steamer, under two different names, and obtaining higher prices for one portion of their consignment than they did for the other. I can further refer to the case of growers who have sent to some of the other States for their trees, and who have received altogether different varieties from those they had ordered, simply because they had given a different name to that by which the fruit was known to the nurseryman. There is a still more weighty reason why we should endeavor to have a uniform system of nomenclature. It is nowadays recognised on all sides that the aid of scientific expert knowledge is a necessity in many of the operations of fruitgrowing. We have to depend on such knowledge for the preparation of the various formulæ which are used in spraying, or in directing us to the best and most economical methods of applying manures. It has already happened more than once to my own knowledge, that valuable information, having special reference to one particular variety of fruit has been published by the fruit experts of some of the other States, but this information has proved either misleading or of no service; because while the experts were referring to one kind, another variety was understood by the growers here. From economic and commercial grounds alone, I think it is desirable that there should be a recognised system of nomenclature established in the Commonwealth. There are, however, other reasons of a more abstruse nature which, I submit, would very properly prove a subject for scientific research. It will be found that fruits can be classified under distinct heads or *groups, and that* there are characteristic features which will enable the observer to place them in their proper order or group. I would lay down the principle that, as far as may be possible, the names of fruits should convey some idea of their character and quality. This is already done in some instances, and we look for the buttery, melting characteristic in the Beurre class of pears. Other names convey some idea of the locality from which they originated. All this may be very proper, but to crowd our fruit catalogues with the thousand and one synonyms, many of which are meaningless and absurd, is surely not a desirable course to adopt. As an instance of what I mean, I was called upon to judge some fruit at one of the principal shows on the North-West Coast, and amongst other exhibits there were three plates of apples which were entered by the names of Dolly, Molly, and Polly. This is an extreme case, I admit, but such incongruities are not so rare as might be supposed. I should like to see the work of classifying and naming our fruits carried out on some distinctly scientific and commonsense basis, and I am convinced that when this is properly done it will be found to have an important economic value to the fruitgrower. Without wearying you with details, it might be interesting to draw attention to one of the modes in which this inquiry should be pursued. Botanical classification is determined very considerably by the various processes of fructification, and in describing fruits themselves the formation of the ovary or seed vessels forms the starting point of our investigations. The variations, however, are in many cases not so obvious as might be imagined, and it is necessary to submit the fruit to close and careful examination, before it is possible to discover distinctive points of difference. With some fruits this is comparatively a simply process, but with others it has yet to be ascertained whether they can be classified by any system, which will be sufficiently invariable to prove satisfactory and reliable. In the case of pears, no system has, up to the present time, been found which can be relied on, for none of the principal structural features of this fruit are invariable. From the same tree—even from the same branch—fruits can be obtained which differ so completely from one another that no reliance can be placed on any system of nomenclature which is based on the internal structure of the fruit. I do not say that some system will never be discovered, for I believe that we shall sooner or later find some method by which we shall be able to separate and classify all the various species and genera. With apples it is different. Thanks to the careful and long-extended researches of such eminent pomologists as Diel, Dochnahl, and the veteran, Dr Hogg, it has been discovered that there are certain variations in the structural form of the ovary which are sufficiently marked and constant to enable a system of nomenclature to be based upon them. I will briefly describe the process of identification. On cutting an apple in halves from top to bottom it will be noticed that there is an opening from the crown or flower end of the fruit extending towards the core, and that this opening, or tube as it is termed, is shaped either like a funnel, or else is conical. At various positions on the sides of this opening will be found the atrophied remains of the stamens, which are on the inside of the tube, while on the outside of the tube will be seen the remains of the sepals or flower. Patient research has shown that these characteristics are sufficiently invariable to enable the pomologist to separate the different varieties of apples into distinct classes, such as: Apples with a funnel-shaped tube, and apples with a conical tube. These may again be sub-divided into three classes, viz: — Apples with marginal stamens; apples with median stamens; and apples with basal stamens. There are also other differences of structure which are sufficiently constant in each variety to enable a reliable classification to be made. Turning to another subject, which, as far as I am aware, has been completely overlooked by our orchardists —I refer to the pollination of fruit trees— I would point out the great importance which this process of nature is to the fruitgrower. It is the answer to the often-repeated question, "Why do not my trees bear better?" Fruitgrowers have long known, though they may never have tried to discover the reason why, that certain varieties of fruits are less fertile than others. It is, however, now recognised by experts that there is a simple reason for such infertility, and that many fruits are practically self-sterile. What I mean is, that it has been proved that some fruits are almost entirely incapable of being fertilised by their own pollen, and require cross-fertilisation before they can become fruitful. This is a very interesting question, and presents some striking features. It has been proved to demonstration that certain fruits should never, as is ordinarily the case, be planted in blocks together. I need not point out how important such a question is to anyone who intends to plant out a new orchard. It is probable that all our fruits would be improved by affording them the fullest change of pollen that can be obtained. This can be easily effected by alternating rows of different kinds, and without adding very materially to the difficulties of picking and separating the varieties. To show how real the advantage is which may be gained by adopting this course, I may mention the case of a large pear orchard at San Jose, in California, which contained 4000 Bartlett, or, as we know them here, Williams's Bon Chretien pear trees. For some years this orchard was absolutely unproductive, but when the owner, in despair, cut down alternate rows and regrafted them with other kinds, immediately the fruit began to set, and he has obtained a good yield ever since. Long before I had heard of this and similar experiments, my attention had been drawn to the subject, and as far back as 1889, I began to make a series of experiments, which, to my mind, were conclusive. As I believe they afford a complete proof of the contention I am making, that certain kinds of fruit ar naturally more or less self-sterile, I wil briefly describe them. I took a series o 32 blossoms of the Winter Nelis pear one of the shyest bearers we have, and fo a number of years in succession, fertilised the blossoms—one-half wit pollen from the same cluster of bud or from the same tree or variety while the other half I cross fertilise with pollen from some other variety which was generally that of th Napoleon or Vicar of Winkfield. Th results of these experiments for the firs three years were as follows:—Out of 1 Winter Nelis blossoms, fertilised wit Winter Nelis pollen, on an average onl one fruit set; out of 16 Winter Nel

# A GEOLOGICAL EXCURSION TO PORT CYGNET IN CONNECTION WITH THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1902.

By W. H. Twelvetrees, F.G.S.,

*Government Geologist*

[Read May 12, 1903.]

The interest attaching to the plexus of felspathoid rocks, now known to occur at Port Cygnet, led to a flying visit being paid to the locality by members of Section C. (Geology) of the Australasian Association for the Advancement of Science, in January, 1902. The occurrence of this division of eruptive rocks in Tasmania is so restricted, and their development is exposed so instructively, that a brief account of the excursion will be interesting to others besides the actual visitors.

Seventeen members took advantage of the opportunity, and travelled to Port Cygnet by one of the Channel steamers, making the trip in a few hours. A call was made at Kettering, in the D'Entrecasteaux Channel, where Professor E. C. Hogg led the party to an exposure of Permo-Carboniferous till, with glaciated pebbles. Oyster Cove, where the belt of alkali rocks comes through from Port Cygnet, was not visited, the entire energies of the expedition being reserved for the better known area at Lovett. Elæolite syenite, essexite and alkali rocks with trachytoidal groundmass, occur at Oyster Cove.

The assistance rendered to the cause of Science by the Hon. Edward Mulcahy, the then Minister of Lands, Works, and Mines, in lending the services of the two State geologists, was appreciated by the members and duly acknowledged at the time. Despite the short time at the disposal of some of the professors, who had to return to Hobart to attend a meeting of Council, the area examined was considerable, the only regret being that members could not linger a few days longer at a spot which it was recognised must eventually become one of classic interest to petrographers.

As the steamer drew near to the jetty at the head of the arm of the Huon, known as Port Cygnet, about a mile south of the township of Lovett, the scene was owned to be highly picturesque. Wooded heights ascend from the water's edge on each side, and large fruit orchards diversify the aspect of the slopes. The view eastwards is shut in by the high range in the background, a ridge of Mesozoic diabase (dolerite), the holocrystalline plagioclase-augite rock, which R. M. Johnston shows, is prolonged southwards from Mt. Wellington and apparently forms the axis of the peninsula which divides the waters of Port Cygnet from the Channel. This high ridge is flanked by Permo-Carboniferous sandstone and mudstone on either side, and, according to F. J. Ernst, crosses the zone of alkali rocks in their N.E.-S.W. course. Westwards the same Permo-Carboniferous beds are found, also broken through by the elæolite syenites, tinguaites and allied rocks, which the members of the Section now hastened to examine *in situ*.

At the extreme head of the arm the water is shallow, and old residents say that it has receded considerably in recent years. The shores are flat, and no good exposures of rock are visible. The first outcrop of the alkali rocks is seen on the shore, between the two jetties, but a more striking development occurs at, and immediately south of, the Regatta ground. This point, the termination of a projecting headland a few hundred feet wide, consists of elæolite-syenite with varieties of alkali and alkali-quartz, syenite passing at each margin into darker varieties, which have been determined by Professor H. Rosenbusch, to whom samples were submitted by the Mines Department, as jacupirangite, essexite, and nephelinite (or monchiquite). Generally speaking, there are no sharp divisions between the central mass of light-coloured syenite and the dark marginal rocks, though well-defined bands and veins of the lighter rock traverse the other, sometimes in such profusion as to form a meshwork. At other times the most gradual variation is seen from one to the other, the lighter variety growing darker by imperceptible stages. The darker rocks also vary considerably, both in texture and colour. It is impossible to resist the conclusion that we are here in the presence of an example of magmatic differentiation. The leucocratic centre is elæolite-syenite, and the dark marginal rocks are differentiated products. Of the latter, the mica nephelinite (containing large crystals of biotite) has only been found as scattered stones, but a little excavation work would probably reveal the bed-rock. The locality is between the Regatta Box and the Point. Professor Rosenbusch says this rock is nephelinite with the habit of a monchiquite, to some extent actually a monchiquite with a groundmass of nepheline, instead of analcime or glass. Monchiquite is usually considered to be a rock composed of the dark silicates in a groundmass of analcime. Some authors affirm the analcime to be Primary, others believe it may be the hydration product of original glass.

The essexite of the Regatta ground is a dark dioritic-looking rock found at the water's edge below the Regatta Box. I have also seen it at Oyster Cove. It consists of labradorite and andesine felspars + augite + amphibole with quartz and iron oxide. Although it possesses the characteristics of its family, it differs, according to Professor Rosenbusch, in type from other essexites known to him, and requires further study.

The jacupirangite (nepheline + augite) is not always so intensely pyroxenic as typical specimens from Jacupiranga. Professor Rosenbusch has, with his usual kindness, furnished me with the following note upon it.

"It is a highly pyroxenic differentiation of the elæolite and alkali syenites at the Regatta ground, Port Cygnet, and possesses the characters of the so-called jacupirangite of San Paulo, in Brazil, and of Alnö, in Sweden. It would be rather interesting to examine the sand of any adjacent creeks which may flow over the syenites with this jacupirangite facies. The interesting mineral, Baddeleyite ($Zr\,O_2$) may be expected to occur."

Further south from this promontory a few dykes were visited on the shore of the Arm, traversing mudstones of Permo-Carboniferous age. One is a green sölvsbergite porphyry, its colour due to aegirine. It contains parallel layers of porphyritic tabular crystals of sanidine. Another dyke, a little further south, contains the new variety of garnet, Johnstonotite. It is a mica sölvsbergite. Professor Rosenbusch calls attention to an undetermined mineral which he has observed in it. He says.—

"This rock contains in small quantities, but widely distributed, a strongly refractive, red, transparent, isotropic mineral, which I have noticed in many other rocks of the alkali series, but which I have not been able to determine yet. I suspect that it belongs to the pyrochlore group."

The next day the party visited Mount Livingstone, one mile N.E. of Lovett, where large collections were made of the beautiful elaeolite syenite porphyry, which seems to form the axis of the hill, and can be gathered in loose blocks on the crest. These rocks had been previously designated phonolitic trachyte and nosean or hauyne trachyte by the writer, but Professor Rosenbusch has identified them as elaeolite syenite porphyries with trachytoid groundmass. He has taken the trouble to accompany his identification with the following remarks. Speaking of the porphyry with the large biscuit-like felspar crystals ("magpie' locally), he says :—

"Large crystals of orthoclase with splendid cleavage parallel to P (001), M (010), and $(\bar{1}01)$, a little triclinic felspar, a few pseudomorphs of natrolite after nepheline, pseudomorphs of iron ores after nosean and biotite (?) and some garnets lie in a very fine fluidal trachytic groundmass of felspars. The pseudomorphs after nepheline are the most charming aggregates of natrolite that I have ever seen, except in the tinguaites from Alnö. At the same time it is also possible that the original mineral was sodalite. These pseudomorphs are also enclosed in the felspars. The rock is strongly impregnated with pyrite. I hesitate only whether to call it an alkali syenite porphyry or on elæolite syenite porphyry."

The pseudomorphs of iron ore after nosean have been a puzzling question for some time, and I sent a slide to Professor Rosenbusch containing a section of one of them plainly replacing garnet, and suggested that garnet may have been the original mineral in all instances. The Professor's reply shows an openness of mind which is refreshing to meet with now-a-days. It is as follows :—

"I agree with you in referring the iron ore pseudomorphs in the slide which you sent me to garnet (melanite). At the same time, I am not sure whether this holds good for the pseupomorphs in my slides. It may possibly do so. The difference in habit may be due to varying thickness of the slices. In my slices the forms remind me of nosean in leucitophyres and allied rocks. Had I seen your slide first, perhaps my interpretation would not have occurred to me."

It may, therefore, well be that some of these iron ore pseudomorphs are really after nosean, while others replace garnet. From the fact that we have undoubted nepheline in in this group of rocks, it is likely that the matrolitic pseudomorphs are after nepheline.

Closely allied with the above is a fresh-looking garnetiferous porphyry of trachytic aspect, with glistening phenocrysts of sanidine, and spotted in places rather abundantly with small soft grey or white crystals of haüyne or nosean. Nosean trachyte or phonolite appeared a convenient name, but Professor Rosenbusch call it a melanite-bearing elaeolite syenite porphyry. He writes :—

"The felspar is fresh and like sanidine. A few small elaeolites are converted for the most part into aggregates of natrolite. The dark constituent is an emphibole with $\mathfrak{c} : c = 20^\circ\ \gamma - a$ weak, $\mathfrak{c} = b$ blue green, $\mathfrak{a}$ greenish yellow.

The garnet is fresh, zonally marked, highy idiomorphic, and occurs not only as phenocrysts, but also as a constituent of the trachytoid groundmass."

The nosean mineral, though plentiful in many specimens of the rock, is rare in others, and is sometimes quite absent. A suggestion was made to me in Victoria that the identification of the nosean might be incorrect. I felt satisfied that no mistake had been made, and Professor David, to whom I showed a slide, confirmed the reference. Professor Rosenbusch also recognised nosean, or haüyne, in a slide which was sent to him. He says:—

"Whether haüyne (rich in Ca) or nosean (rich in Na) is present cannot be determined without chemical investigation, but one of these two minerals is undoubtedly here."

I do not know that nosean or haüyne has been recorded elsewhere in Australasia.

Mount Mary is situate to the west of Lovett, and a trip made to it disclosed the occurrence of other members of the alkali series. The elaeolite, or alkali syenite porphyry, with the biscuit-like felspar phenocrysts, was seen at the Mount Mary mine, and a little above it the hillside was strewn with stones of green tinguaite, or fluidal tinguaite porphyry. The summit is occupied by a grey tinguaite porphyry, with large glassy sanidine felspars, and rich in fresh-looking melanite, but poor in nepheline. It occurs in contact with Permo-Carboniferous sediments, impregnated with pyrites. Near the summit are outcrops of the alkali syenite intrusion, which apparently forms the mass of the mountains.

On the Back Road the plutonic rock is well exposed. With respect to this Professor Rosenbusch writes:—

"It consists of dull orthoclase, fresh and beautifully zoned albitic felspar, with basic margins; augite ($\mathfrak{c} : c = 48^\circ$) green in colour, with occasional narrow margins of deeper tint passing over into aegirine augite. The rock belongs to the alkali augite syenites, though it does not agree with either Pulaskite, Nordmarkite, Umptekite, or Laurvikite, &c.; in fact, it does not correspond exactly with any of the numerous rocks of that series. According to its dominant structure, I would call it either an alkali syenite with porphyritic facies, or an alkali syenite porphyry with granular facies."

The visit of the members of Section C. to Port Cygnet has proved of double value to the cause of geological science, inasmuch as it has led to the above remarks from this great German master of petrology.

These intrusive rocks carry pyrites, and along the lines of their contact with the Permo-Carboniferous sedimentary strata some silicification has taken place, accompanied by a concentration of pyrite. Some of the contact stone assays 5 to 6 ozs. silver and from ½dwt. to 2 or 3 dwts. gold per ton. The district has yielded about 3000 ozs. alluvial gold, most of which was derived from the small flats near Lymington.

The variations which distinguish the Port Cygnet rocks from alkali rocks elsewhere may be appealed to in illustration of the theory of petrological provinces. They cannot be exactly correlated with the known members of the series elsewhere, and possibly new names may be required for some of them.

The study of the group is not complete, and as it progresses readjustment of the nomenclature are inevitable, but at present the series would be arranged as follows:—

## ALKALI ROCKS.

*Family* 1.—ALKALI GRANITE.

Not represented.

*Family* 2.—ALKALI SYENITE.

(*a*) Plutonic representatives :—

1. Quartz augite syenite: a medium-grained, yellowish rock at Regatta Point (alkali felspar + augite + quartz).
2. Alkali syenite at Regatta Point and on Back Road (orthoclase and albitic felspar + augite + amphibole with accessory biotite, quartz, sphene, and apatite). Has frequently a porphyritic facies.

*Family* 3. ELAEOLITE SYENITE.

(*a*) Plutonic representatives :—

1. Elaeolite syenite: coarse syenite rock at Regatta Point, and near top of Mount Mary (alkali felspar + elaeolite + alkaline pyroxene + amphibole). Contains melanite and biotite, also hydronephelite after elaeolite [or sodalite], and accessory sphene and apatite.

(*b*) Complementary and dyke representatives :—

1. Elaeolite Syenite porphyry, viz –
    - (i.) The biscuit felspar rock on Mount Livingstone and Mount Mary ("Magpie") [orthoclase and a little triclinic felspar + alkaline pyroxene and amphibole + melanite and iron ore pseudomorphs after nosean and garnet with natrolitic pseudomorphs after nepheline (or sodalite)]. Has a fluidal felspathic groundmass.

(ii.) The nosean rock on Mount Livingstone, closely related to the preceding. (Sanidine + amphibole + alkaline pyroxene + melanite + nosean or haüyne. Aggregates of natrolite after small crystals of nepheline.

2. Mica sölvsbergite. Dyke on beach one mile south of Regatta Point: (orthoclase and albite felspars + brownish yellow mica + garnet + a pyrochlore mineral (?).
3. Sölvsbergite porphyry. a little north of the preceding. (Phenocrysts = sanidine + aegirine and natrolite after aegirine. Groundmass = acicular aegirine + sanidine + analcime and a little nepheline.
4. Tinguaite porphyry: On Mount Mary (Phenocrysts = aegirine augite + melanite + sanidine + sphene + nepheline. Groundmass = sanidine + acicular aegirine + analcime.
5. Jacupirangite: at Regatta Point (nepheline + augite.)

***Family* 4.—ESSEXITE.**

(*a.*) Plutonic representatives.

1. Essexite, dàrk, dioritic-looking rock below the Regatta Box (Labradorite and andesine felspar + augite + amphibole + quartz).

***Family* 5.—THERALITE.**

(*a.*) Plutonic representatives absent.

(*b.*) Complementary and dyke representatives:—

1. Mica nephelinite. At Regatta Point (Nepheline + augite + biotite + amphibole and accessory apatite. Has the habit of a monchiquite.

***Family* 6.—IJOLITE.**

This is not represented, unless with H. Stanley Jevons* we detach jacupirangite from the elaeolite syenite family and place it among the felsparless ijolites. Its tendency to variation in mineral constitution and its usual intimate association with elaeolite syenite incline me to retain it as a differentiation of that magma.

The alkali rocks are also found in other parts of Tasmania, and to make their enumerations complete I cite the additional localties, viz:—

***Family* 4.—ESSEXITE.**

(*c*) Effusive representatives:—

1. Trachydolerite: the bluffs at Table Cape and Circular Head (labradorite + augite + olivine, with analcime and apatite (and nepheline?).
2. Melilite basalt: on the Shannon Tier, at Sandy Bay, and near Rokeby (melilite + olivine (sometimes as fayalite) + augite + perofskite.

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* A systematic nomenclature for igneous rocks. H. S. Jevons, M.A., Geol. Mag. 1901, p. 304.

*Family* 5.—THERALITE.

(*c*) Effusive representatives :—

1. Nephelinite : on the Shannon Tier (nepheline + augite).
2. Limburgite: a dyke on the Emu Bay railway, near Burnie (olivine + augite).

The alkali rocks form one of the two primary divisions of the eruptives. One division is that comprising granites, syenites, diorites, gabbro, and the ultra basics: the other comprises the alkali eruptives. The latter, though not so universally abundant as the former, illustrate a remarkable aptitude for differentiation in the alkaline magma: hence numerous variations from typical forms and increasing additions to the nomenclature. The occurrences of Tasmanian rocks belonging to this division are consequently of distinct interest to both the petrographer and the geologist.

# TASMANIA: FROM A MANUFACTURING AND IMMIGRATION POINT OF VIEW, AND HER NATURAL ADVANTAGES.

By A. O. Green,

(Read May 12th, 1903.)

When we read of twenty thousand immigrants arriving in the north-west of Canada in a single month, it seems hard to account for the very slow increase of the population in Tasmania, especially when her many advantages are considered.

It is the object of this paper to enumerate these advantages. In doing so, it will be necessary to state some things that are self-evident to us; but it is good to recognise the advantages of the land we live in, and, if the knowledge can be communicated to others, it may tend to the success of the object in view, namely, to increase our present population of about one hundred and eighty thousand people very considerably.

Our small population has been one reason of our fewness, as in the past, owing to artificial divisions among the States of what is now the Commonwealth of Australia; our produce was shut out from the markets of the mainland, so that practically we could only deal with the small population of the Island. Now our local customers, owing to the Federation of Australia, number nearly four millions, and a great impulse has been given to the trade of the Island, which if taken advantage of, may lead to Tasmania becoming a manufacturing and distributing centre for Australia.

## Position.

Tasmania is very favourably situated geographically, being only a short distance to the south of the mainland of Australia, and, roughly, in a central position with regard to the coast line of that country. It is also in the direct line between New Zealand and South Africa. Its shore line is considerably broken by deep inlets of the sea, and the greater part of the country is near water carriage, thus bringing the markets of the world within easy reach, at a small cost for carriage.

## Climate and Soil.

The climate is equable and temperate, and the rainfall is regular, so that extremes of drought and heavy floods are unknown ; in favoured situations oranges and lemons can be ripened in the open air ; geranium hedges are common, and snow only lies in the elevated districts. The days are usually bright and pleasant, and the nights, even in the hottest summer, are cool and bracing.

The central parts of the Island are at an elevation of 1000 to 3000 feet, and it is easy to get a considerable change of climate by travelling a short distance. Upon these upland districts are large lakes, supplying quickly falling streams, from which ample power can be obtained.

*Soil.*—The soil is of good average fertility, and in some districts exceptionally fertile. The average crop for the Island is over 20 bushels of wheat to the acre, and 5 tons of potatoes. In some districts the average is considerably higher, and potato crops of 12 tons to the acre are not uncommon. In well-managed orchards three to five hundred bushels of apples are picked per acre.

### Advantages.

The present year is the one hundredth since Tasmania was first colonised, and on every side there are indications that in the near future Tasmania will become one of the most prosperous States of the Empire. The towns, though small, have most of the conveniences of large European cities, in the way of water supply, well-paved streets, good buildings, telegraphs, telephones, gas, electric light, and electric trams. The country districts are connected with the ports by lines of railway, and good macadamised roads; the country has been opened. The effect of climate and soil on the growth of crops and the rearing of cattle and sheep is well known. The method of dealing with fungi and insects inimical to cultivated crops has been put upon the solid basis of experience, and there is every prospect of remunerative employment for a very much larger population than Tasmania has at present. While Victoria was passing through the first excitement of the gold diggings, Tasmania supplied a very large portion of the food of that colony, and, owing to the facilities of water carriage, can still place produce in Melbourne and in other capital cities of Australia at a lower rate for freight than mainland districts that are very much nearer to those capitals.

The advantages of the climate and soil of Tasmania have been brought into great prominence by the dry seasons that have obtained upon the mainland, culminating in the severe drought of last year, and many mainland farmers are coming to Tasmania to farm, where the land laws are liberal, the horrors of drought, extremes of heat, and devastating floods are unknown, and in many places grass is green all the year round. Also, owing to her position, and available water power, and that factory legislation in Tasmania places less restriction upon trade than other States of the Commonwealth do, it is certain that factories will be set up in Tasmania in preference to other parts of the Australian mainland, and there is already a noticeable increase of activity in agriculture, trade, and manufacture.

*Freetrade.*—In the past the transfer of produce was very much hindered by intercolonial duties, but these are now all done away with.

## Small Industries.

It is undoubted that in the first place the prosperity of new countries must depend largely upon agriculture, especially upon what are termed small industries—industries where profits are derived from the economical working of the soil, and which enable large families to live comfortably on small acreages. The growth of fruit and potatoes meets this requirement, and thereby it is quite possible to have a population of as much as one to the acre. In this, these industries differ widely from what until recent years has been the staple industry of the State—the rearing of sheep and export of wool. In rearing sheep, people strive for loneliness, so that the sheep may not be disturbed, and in many cases efforts are made to keep population away; but with small industries supporting families of ten, upon ten to fifty acres of ground, well tilled, it is quite possible to support a population of one to the acre, as subsidiary mechanical industries, such as sawmills, wheelwrights, carpenters, blacksmiths, tailors, shoemakers, tinsmiths, casemakers, all follow, just as water fills up a hollow.

*Fruit.*—During the past twenty years the fruit export industry has been developing, and in 1902 fruit and jam were exported to the value of nearly £450,000, being an increase of about 30 per cent. on the preceding year. This industry has been growing at an increasing rate for some years past, has been the cause of widespread prosperity, great increase in the value of land, and has brought several trades to Tasmania previously unknown in the Island.

*Potatoes.*—Potato-growing has become another large industry. During last year potatoes were exported to the value of £325,000. Both potato and fruit culture need only small capital, and small holdings, and the benefit from them is very widespread, tending more to the general prosperity than industries in which only a few are benefited. They also are bringing other industries in their train, in the canning, drying, preserving, and packing for distant markets.

*Canning and Drying.*—These trades of canning, preserving, and drying are as yet in their infancy, but when they are fully developed fluctuations and gluts in the markets will be largely done away with. There is very little done in drying potatoes, for which there are splendid opportunities.

*Starch.*—There are no factories for making starch, although conditions are favourable for this industry. On some occasions, during recent years, large quantities of potatoes that have missed the market have been spoilt, thus causing great loss.

*Spirit.*—The making of starch entails the making of spirit, which would be another item of profit.

*Cider.*—Cider also could be made very largely, and besides being a source of profit in itself would help to steady the fruit trade. Cider is made in a small way at present, with very fair success, but not as a large business. In some of the fruitgrowing districts in England, the cider press comes round to the farmers just as the chaffcutter, threshing machine, and straw baler do here.

*Oats and Barley.*—The northern parts of the Island are especially suited for the cultivation of barley and oats, both for the home market and for export. In 1902 about £140,000 worth of oats were exported.

*Hops.*—Hops also do well, and are cultivated successfully to a limited extent. The exports for 1902 are valued at about £33,000. This business could be considerably extended.

*Beer.*—Owing to natural conditions, better beer can be brewed in Tasmania than in other parts of the Commonwealth of Australia.

*Weaving.*—Small beginnings have been successfully made in the weaving of blankets, flannel, and tweed, and in the making of biscuits. Under the new Customs regulations all these industries are likely to grow.

*Steam Communication.*—One of the results of the growth of the above industries has been an increase in the tonnage of steamers calling at the ports of Tasmania, not only from the other colonies, but from Europe. The tonnage for 1903 (the present year), entering the port of Hobart alone, is estimated to reach about six hundred thousand tons net, or a million tons gross. This port is a fine open sheet of water, completely landlocked. The wharves, situated 12 miles from the sea, can berth the largest ocean-going steamers, and during the past season single vessels have been loaded with up to twenty thousand tons of cargo, and have left the wharf without trouble, drawing thirty-one feet of water. At present the steamers from London, *viâ* the Cape, to New Zealand make Hobart a port of call; also arrangements are being made for a new line from New Zealand to the Cape; and, besides this, the P. and O., Orient, Pacific, White Star, Holt's Blue Funnel, and intercolonial steamers of several companies call at various ports in the island. The new line of steamers about to be started from New Zealand to the Cape, making Hobart a port of call, besides increasing the facilities of transport, will be likely to lower the cost of living.

There are prospects of several other trades, that are at present minor industries, growing, in the near future, to a large volume.

*Butter, Cheese, and Poultry.*—The climate and soil of the island are exceptionally good for the production of butter, cheese, bacon, eggs, and poultry. Large cool storage works are being erected both at Hobart and at Launceston, and by their help there will be every opportunity for developing a large export trade in these commodities.

*Fish.*—Not only do the large lakes and rivers abound with salmon and trout, as well as native fish of several kinds, but the sea round the coast, and the estuaries, are abundantly supplied with fish. At present the fishing industry is without organisation, and is carried on upon a small scale. Freezing works and cool storage are only just being established. Canning, drying, and salting are also in their infancy. Owing to the lack of these conveniences in the past little could be done with large catches, but fish of many varieties are abundant upon the coast at different times of the year; and with the advantage of cool storage, and, with the development of canning and salting, and the present facilities of communication, there is every probability that the fish trade will become a large industry. Now the boats are small, and the men get a precarious livelihood; but when freezing, salting, and canning are established the effect will be to cause the industry to settle down upon reliable lines, and there will be no difficulty in preserving catches of any size, and in distributing them amongst the markets of the world.

*Hides, Skins, and Leather* were exported in 1902 to the value of £76,958.

*Rabbits.*—A new industry has been profitably established this year in the export of rabbits to England for food, and to the end of August, 1903, 14,061 crates, containing 351,525 rabbits, have been exported, valued at £7323 7*s.* 9*d.*

## Timber, Tan Bark, Perfumes, &c.

The acacia (known as wattle), a tree which is common all over the Island, produces a bark rich in tannin, and would well repay systematic cultivation. The bark is collected in a somewhat wasteful and primitive way from the natural growth, but the cultivation of wattle in plantations is unknown, although it is probable that if systematically carried out it would be a very profitable industry; wattle bark to the value of £40,000 was exported during 1902. A large extent of the country, especially the eastern half of the Island, where land is to be had at a reasonable price, will grow wattle bark to advantage. Flowers of many kinds for perfume and honey, would do well; fruit also could be grown to advantage, and would probably ripen earlier than in the districts already planted, would realise good prices, and would enable the present output to be very largely exceeded without increasing the difficulty of disposing of the crop. The East Coast, though settled in the early days, has been lying dormant for many years, but it can be recommended to persons wishing to acquire land which would not involve the very heavy labour of clearing. The climate of the East Coast is remarkably equable and salubrious, even for Tasmania; the rainfall is regular, and the soil is of good average fertility. The East Coast appears an ideal place for the production of fruit, honey, and perfumes. Neither honey nor perfumes are made as an industry in Tasmania, although in other countries less favourably situated, incomes amounting individually to thousands of pounds are made from these industries.

At the present time large districts in Tasmania are covered with forests, growing trees of immense size, and there are great possibilities in the systematic development, not only of the timber trade, but also of the allied industries. The seeds of Tasmanian trees have been planted all over the world, and it would be safe to say that there is a larger trade in utilising the timber grown from Tasmanian seed in foreign countries than in utilising the timber of the Island itself.

There are also great possibilities in the distillation of the essential oils contained by a large proportion of the leaves and flowers of the Tasmanian flora. Of these the oil of the *Eucalyptus globulus* is exported, and is known widely for medicinal purposes, and for the making of varnish. Very little is done in the small industries, such as brushware, cooperage, hurdles, baskets, tool handles, walking sticks. The drying and seasoning of timber for the better class of work by artificial means, the making of potash, pyroligneous acid, and wood pulps, are all untouched. And neither the conservation of the forest nor the planting of native or foreign trees for profit is practised. There are very large possibilities in turning to account the great forest wealth that exists in Tasmania, and when it is thought that of the £26,000,000 that is paid annually in England for imported timber none is paid to Tasmania, it is evident that full advantage has not been taken of this great natural source of wealth.

In the foregoing especial stress has been laid on the number of businesses that can be successfully carried on in Tasmania. In each and all of these businesses large capital can be profitably invested; but they have the further advantage that it is equally possible for men of small means to make a comfortable income, and special attention has been called to them, as they may form the sources of wealth for a large resident population.

### Pastoral and Mineral.

Another industry of Tasmania is the breeding of stud sheep and the production of wool. Tasmania, from its cool climate is capable of producing the very finest sheep, and it is a necessity that the warmer colonies should constantly replenish their stock from a cool climate like Tasmania, in order that the staple of the wool may be preserved. Tasmanian stud sheep are celebrated all over Australia, and bring in large incomes to those who carefully observe the conditions that are required for success. Wool was exported in 1902 to the value of over £263,000.

The last industry to be mentioned is the winning of metals. Tasmania is so rich in so many kinds of ore that the Island has been called a casket of precious stones. The value of mineral exports is about one and three-quarter millions annually, with every prospect of an increase, both by improved methods of winning and the discovery of fresh mines; as large parts of the country, although known to be metal-bearing, have never been prospected.

One of the most promising industries for future development appears to be the production of iron, as there are large deposits of haematite of great purity along the North Coast of the Island, with every facility for working There are also deposits of magnetite, with an admixture of chromium.

The value of minerals raised to date is as follows :—

| | |
|---|---|
| Gold | £4,651,303 |
| Silver-lead | 2,379.279 |
| Tin | 6,612,268 |
| Copper | 4,076,396 |
| Coal | 617,301 |
| Iron Ore | 13,371 |
| Wolfram | 2157 |
| Asbestos | 251 |
| | £18,352,326 |

and particulars of some mines are :—

*Gold.*—The "Tasmania," at Beaconsfield, was found in 1877, and has crushed 495,895 tons of quartz, yielding 569,778 ounces of gold. Paid-up capital, £163,200; dividends distributed, £772,072.

The "New Golden Gate," at Mathinna, with £7390 of paid-up capital, has crushed 218,216 tons of quartz, yielding 191,357 ounces of gold, and has distributed in dividends £326,400.

*Silver.*—The "Western," at Zeehan, capital paid up £29,600, has produced 3,702,912 ounces of silver, and 20,321 tons of lead, and has paid in dividends £102,000.

*Tin.*—The "Mount Bischoff," at Waratah, capital paid up £29,600, has distributed in dividends, since found in 1871, £1,885,000.

*Copper.*—The "Mount Lyell," at Queenstown, found in 1886, but not systematically worked till 1893, has produced 46,856 tons of blister copper, and has paid dividends amounting to £900,637; capital, £825,000.

### General.

The present is a good time to bring under public notice the many advantages possessed by Tasmania. The benefits of intercolonial freetrade are already noticeable. New businesses are springing up, land is increasing in value, and people of other colonies are coming to Tasmania. In the present days of competition it is not sufficient to possess a good thing, but it is absolutely essential that the advantages of this possession should be made known. There are so many parts of the world, less blessed than Tasmania, with large populations, hardly able to make a living, while in Tasmania there is room for a very much larger population. It should be our endeavour to make known the advantages possessed by Tasmania. This subject has been mentioned on many occasions, and was especially referred to at our last meeting. It is not wise to indiscriminately invite all sorts of people to come to Tasmania, or to any other part of the world. It has also to be borne in mind in coming to a new country that new experience is necessary. Experience gained in large communities or other countries may be of value, but before launching out in a new country it is absolutely essential to obtain a knowledge of local conditions. In agricultural pursuits, for instance, climate and soil must be thoroughly understood. The assistance of Government to new-comers is not essential. There are plenty of opportunities in Tasmania for the new-comer, who is determined to make his home here, and to succeed. This they will do without assistance, either from the Government or from anyone else. But it appears eminently a thing that the Government can do through an Agent-General or other means; namely, to disseminate reliable information as to the many advantages that Tasmania possesses—in position, climate, soil, water power, civilisation, and in growing industries. Streams of emigrants are going to many countries from England. Very few of them are coming to Tasmania. In the other colonies, at the present time, many people are looking for a new home, undecided where to go. From the prominence given to South Africa in the papers many have decided to go there, who might have come to Tasmania at less risk, less expense, and with good chances of success had the advantages of Tasmania been more widely known.

In closing I venture to express a hope that the discussion on this paper may lead to a wider knowledge of Tasmania, and would suggest, as a further means to the same end, that it would be very desirable to enrich the technological side of our museum by exhibits of—

Models of fruit, vegetables, and roots ;
Exhibits of cereals, grasses, and hops ; and

Exhibits of biscuits, bricks, blankets, bluey, candles, flannels, fruit (dried and preserved), canned fish, furs, furniture, pottery, soap, wood carving, and other examples of Tasmanian manufactures.

His Excellency Sir A. E. Havelock, G.C.S.I., G.C.M.G., the President, warmly commended the paper, and suggested that the discussion be commenced that evening, and continued at a subsequent meeting.

## Statistics for the Year 1902.

| | Acres. |
|---|---|
| Area—Total | 16,778,000 |
| alienated | 4,955,550 |
| in crop | 276,239 |
| in artificial grasses | 319,090 |
| | Souls. |
| Population | 177,077 |
| | £ |
| Revenue | 896,593 |
| Public Debt | 9,228,863 |
| External Trade | 5,687,253 |
| Imports | 2,442,745 |
| Exports | 3,244,508 |
| Pastoral products | 1,273,418 |
| Mineral " | 1,660,000 |
| Agricultural " | 1,751,654 |
| Manufactured " | 1,120,000 |
| Assessed Annual Value of property | 1,023,204 |
| Private Wealth, Real Estate and Personalty | 49,000,000 |

# NOTES ON TASMANIAN MINERALS.

## By W. F. PETTERD.

(Read September 14th, 1903.)

THE present paper records the more recent results of the continued investigation into the mineralogy of this State, from which it will be found that not only are several unrecorded localities enumerated for minerals which have been previously catalogued in former contributions on the subject to this Society, but also that not less than 13 species are now added to a remarkably long list.

Two peculiar chemical varieties of well-known substances are for the first time described, both of which are from one locality, and owe their unique features to a common cause. Several of the species are of special interest to the geologist, and a few are of commercial importance; but it may be needless to say that mineralogy deals with a variety of substances usually placed under that particular branch of scientific investigation, irrespective of their individual intrinsic value. In fact, by far the major portion but interest the geologist, the chemist, and those in search of some of the most beautiful of Nature's treasures.

So much is now known of the mineralogy of this State that the flood of discovery in this particular field is without doubt past, and it is only by the most strenuous efforts, coupled with close application, that additions to the minerals already known to occur can be made; but, needless to say, as to peculiarities of occurrence and chemical analysis much remains to be done.

I have to express my most grateful thanks to many friends for ready assistance as in the past, and generous donations of both beautiful and interesting material for this addendum, as well as for facilities for collecting and opportunities for the examination of many minerals *in situ*.

To Mr. R. F. Waller, General Manager of the Magnet Silver-mining Company, who is a most enthusiastic mineralogist, I am specially under obligation, both for collecting at his particular locality, as well as for assistance in the identification by blowpipe and other determinations.

1 ALBITE.—(*Polysilicate of aluminium and sodium.*)

In solid irregular milk white subtranslucent compact masses, apparently of secondary origin. Locality: Heazlewood River.

**2** ALLOPHANE.—(*Hydrate silicate of aluminium.*)

Found as irregular, fairly large masses, outwardly coated with a pulverulent white powdery substance of secondary origin. The colour varies from pale yellow to a much darker shade. The general appearance of the mineral is remarkably gum-like. The composition is quite unusual, but there is little doubt about the identification.

Analysis by Mr. Watson, of the Magnet Silver-mining Company:—

$Si\,O_2$ = 19·00
$Al_2\,O_3$ = 40·40
$Fe_2\,O_3$ = 4·70
$Ca\,O$ = 69
$S\,O_3$ = 1·61
Ignition = 33·30

99·70

**3** ANTIMONY (*Native.*)

Occurs in thin radiating patches, about an inch in diameter, on a silicious gangue. This is the first record of the occurrence of this somewhat rare mineral in this State. I have only seen one specimen, and that is in the collection of Mr. R. F. Waller, although I am informed a slab about a foot square was obtained, practically covered with the radiating metal. Locality: Spray Section, British Zeehan Mine, Zeehan.

**4** APATITE (*Phosphate of calcium.*)

As very minute crystals, about two millimeters in length, of a pale pinkish colour, abundantly scattered throughout a stanniferous granite. Crystal Hill Mine, Blue Tier.

**5** ARRAGONITE (*Orthorhombic carbonate of calcium.*)

Occasionally obtained in vughs in basalt as subradiating thin columnar crystals, which do not rarely exceed 2 inches in length. They are highly polished, glassy clear, and colourless. This is by far the finest occurrence of this mineral in the State. Locality: Briseis Mine, Derby.

**6** BERESOWITE (*Chromate and carbonate of lead.*)

This mineral has been found to be much more abundant at the Magnet Mine than hitherto supposed. It occurs in the decomposed or superficial portion of the lode, and is confined to cracks and small vughs in the gossan, where it forms coatings of almost microscopic plates and crystals, which often nestle in little bunches. The crystals are bright and sparkling, usually a shade of yellow to orange, but sometimes a bright crimson. It commonly decomposes to a yellow lead oxide. In the abandoned workings of the old Whyte River Silver Mine, Mr. R. F. Waller obtained some nice slabs of a decomposed rock, literally coated with the characteristic crystals of this substance. Its bright colour renders it an attractive object, but the soft base upon which the crystals are usually implanted causes it to be extremely difficult of transport. It has not so far been noticed at any other of our silver-lead mining localities. In fact. its occurrence in the Heazlewood district appears to be the first outside its original locality at Berezov, in the Ural.

7 CASSITERITE (*Dioxide of tin.*)

Occurs of unusual habit at Mayne's Mine, Heemskirk. The colour varies from a pale dull grey to almost black, and is commonly of a radiated fibrous structure in botryoidal and reniform shapes. Where the concentric structure is well defined, the internal coloration is in bands of regular width, of various shades of grey to brown. In all essential characteristics this occurrence exactly corresponds with what is known as "wood tin" in Cornwall, England.

An acute pyramidal, intensely black variety, representing what has been termed sparable or "needle" tin in the European mining districts, occurs at Welsh's tin find near the five-mile on the Waratah-Corinna-road. The crystals are minute, very pointed, and a good imitation of the old-world form.

A remarkable occurrence of cassiterite has recently been discovered at Mount Bischoff by Mr. Bradford, in which cellular cavities, retaining in most instances the form of orthoclastic felspar, have been lined, and sometimes completely filled, with a mass of minute, well-developed, tetragonal tin crystals, combined with pycnite. The cavities are small, but perfectly distinct. The original porphyry has been almost completely topazised, simply leaving granular interspersed quartz. The replacement of the felspar with cassiterite is not so complete as that recorded from the Mount Rex Mine, where pseudomorphism has gone to the fullest extent.

In the Bischoff specimen the two minerals, pycnite and cassiterite, form a coating in the cavities, and it is but rarely the whole space is filled with the substitution. The intensely black cassiterite, with the milk-white base, forms a striking contrast of considerable interest.

The occurrence forms a remarkable illustration of the probable action on the original rock by chemical changes, by which the topazisation occurred, and the tin crystals were deposited in the cavities of dissolved orthoclase.

At the Stanley River numerous remarkably fine pseudomorphs of compact black cassiterite after orthoclase have recently been discovered. This replacement shews the clearly distinct crystal outline of the felspar imbedded in an almost milk-white porphyritic rock, mainly composed of quartz and felted masses and radiating bunches of short and opaque crystals of tourmaline. This last-mentioned mineral is of an intensely dark-green colour, and belongs to the variety which has been named zeuxite, and which hitherto was supposed to be almost restricted in this island to Mount Bischoff. Pseudomorphs of this mineral also after felspar are somewhat abundant at the same locality.

Mr. R. F. Waller has shewn me a small specimen of topazised porphyry from Mount Heemskirk—a quite new locality for this mineral.

8 CHALCOPHANITE (*Hydrated manganese and zinc protoxide.*)

In aggregates of well-formed tabular crystals of a bluish-black, and highly polished. Locality: Magnet Silver Mine. Magnet.

9 CHRYSOBERYL (*Aluminiate of beryllium,*) variety *Alexandrite.*

A remarkably fine example of this highly-prized gem stone was obtained by Mr. J. A. Thompson at the Weld River in stanniferous drift, during the ordinary streaming process of dressing tin ore. It is of a somewhat pale but attractive green colour, red by transmitted light, as is characteristic of the variety. It was by the kindness of Mr. Thompson tested with the dichroiscope by Mr. W. H. Twelvetrees, Government Geologist, with the result that its identification in the gossan, where it forms coatings of almost microscopic plates and crystals, which often nestle in little bunches. The crystals are bright and sparkling, usually a shade of yellow to orange, but sometimes a bright crimson. It commonly decomposes to a yellow lead oxide. In the abandoned workings of the old Whyte River Silver Mine, Mr. R. F. Waller obtained some nice slabs of a decomposed rock, literally coated with the characteristic crystals of this substance. Its bright colour renders it an attractive object, but the soft base upon which the crystals are usually implanted causes it to be extremely difficult of transport. It has not so far been noticed at any other of our silver-lead mining localities. In fact. its occurrence in the Heazlewood district appears to be the first outside its original locality at Berezov, in the Ural.

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**10** Chromiferous Mimetite (*Arsenate of lead with chromic acid.*)

This variety never assumes the barrel-like shape so common to the typical mineral. It is found in short hexagonal prisms and plates, with basal terminations, usually about 1 millimeter in breadth and length. The colour varies from a decided brownish-green to deep orange; it is shining and opaque. The streak is orange to siskin-green. Before the blowpipe in salt of phosphorus it remains green when cold in both flames. In closed tube with splinter of charcoal and heated intensely it gives very strong and characteristic reactions for As. $O_4$; with cupric oxide gives flame reactions for Cl., and in closed tube with magnesium wire the odour of $P_2 O_5$. It is reduced to metallic lead with soda on coal. This is a variety sufficiently distinct in composition, colour, and habit to be worthy of record. It is rarely met with at its only locality, and then in comparatively small groups of crystals, but its peculiar colorization, combined with the habit of usually occurring in thin plates, at once arrests attention. The chemical reactions shew that it is more allied to mimetite than to pyromorphite, a chromiferous variety of which has been recorded. Locality: The Magnet Mine, attached to the gossan in the superficial workings.

**11** Chromiferous Cerussite (*Lead carbonate with chromic acid.*)

This attractive variety of a common species is, so far as known, confined to the Magnet Mine, in the upper workings of which it is, although local, fairly abundant. It occurs in fractures and vughs in the gossan zone, but in bunches and sparsely attached as beautiful little crystals, generally in close association with crocoisite, but never, so far as observation has gone, intermixed with the normal form; although this is somewhat abundant in its usual adamantine characteristic habit, often shewing remarkably perfect development in stellar and cruciform triplet crystals.

It is noticeable that, while the variety under review is invariably associated with the chromate of lead, the common type is rarely, if ever, obtained in the vicinity. It is always opaque, with a shining lustre, but not adamantine. The colour is canary yellow, with an occasional tinge of red where the crystal has impinged upon the chromate. The tint does not vary to any serious extent, although paler examples are occasionally met with. It is a most attractive mineral, and soon arrests attention. Its most constant feature is its crystallisation in flatish frondose and spear-headed groups, twinned by repeated angles across different faces of the prism (110). The striated faces of the twinned groups are the brachyprisms O11 and O13; these are commonly deeply grooved, affording a most interesting leaf-life and unfamiliar appearance.

This variety is perfectly distinct, both as regards colour and habit of crystallisation. Moreover, intermediate variations between it and normal type have not been met with. It is undoubtedly one of our most attractive and typical minerals. Under the blowpipe gives reactions for chromic acid.

**12** DOLOMITE (*Carbonate of magnesium and calcium.*)

A somewhat unusual occurrence, in the form of small attached, doubly-curved or saddle-shaped crystals, which are opaque and white. Magnet Silver Mine, Magnet.

**13** DIOPSIDE (*Metasilicate of calcium, iron, and manganese.*)

This almost white variety of pyroxene occurs, both massive and crystallised, at the Tenth Legion Mine, Comstock District. Analysis:—

$Si\,O_2$ = 52·1
$Al_2\,O_3$ = 3·0
$Mg\,O$ = 15·0
$Aa\,O$ = 27·7
$Fe\,O$ = 2·3

100·1

Specific gravity 3.23; hardness, about 6. (G. Waller: Report on the iron and zinc-lead ore deposits of the Comstock District, 1st February, 1903.)

**14** DUFRENITE (*Basic ferric phosphate.*)

Occurs as a thin incrustation of an olive to blackish-green colour on zinc-bearing gangue at the Bell's Reward Mine, Heazlewood.

**15** EMBOLITE (*Chlorobromide of silver.*)

In minute but perfectly cubical crystals, which are occasionally octrahedrous. Occurs in a seam of gossan at the Magnet Silver Mine, Magnet.

**16** FELSPAR (*Polysilicates of aluminium potassium, &c.*)

The following note on this important group is kindly supplied by Mr. W. H. Twelvetrees, Government Geologist:—

*Orthoclase* occurs in our granites, syenites, elvans, and quartz porphyries. The most common com-combinations are (010), (110), (001). Carlsbad twins [twinning plane parallel to the orthopinacoid] (100) are frequently seen. The crystals are generally turbid from decomposition into kaolin, or muscovite. Replacement by pinite chlorite, &c., has occasionally taken place. Porphyritic crystals of an inch or two in length are common in the granite of the East and North-East Coasts.

*Sanidine.*—This pellucid monoclinic felspar is found in the alkali syenites and elaeolite syenite porphyries of Port Cygnet. It frequently shews zonal structure.

*Plagioclase Felspars*, albite, oligoclase, andesine, labradorite, bytownite, anorthite, form a continuous series, in which, according to Tschermak, albite and anorthite are opposite extremes. The intermediate felspars have been shewn by Schuster to be isomorphous mixtures of albite and anorthite.

*Albite* occurs as replacement of the groundmass of porphyroids or keratophyres at Mount Read; in larger crystals in the actinolitised slates in the North Dundas District. Intergrown with orthoclase, it forms microperthite; seen in granite at Anderson's Creek and in alkali syenite at Port Cygnet.

*Labradorite* is the felspar of our basalt and dolerite (diabase). Labradorite-bytownite and bytownite-anorthite felspars characterise the gabbros at the Heazlewood, Bald Hill, &c.

*Oligoclase*, with its narrow twin lamellae, is the plagioclastic felspar of our granites. Andesine occurs in essexite at Port Cygnet.

*Microcline*, though chemically identical with orthoclase, is triclinic in crystallisation. Basal sections microscopically shew a characteristic cross-hatched twinning, due to the intersection nearly at right angles of the twin lamellae of two types (albite and pericline). Seen in granite porphyry at St. Marys, and in granite elsewhere.

**17** Galenite (*Sulphide of lead.*)

At the Magnet Silver Mine somewhat fine pseudomorphs of this mineral, after sphalerite, have occasionally occurred. They are usually in irregular groupings, with drusy surface and glimmering lustre.

**18** Göthite (*Hydrous sesquioxide of iron.*)

Occurs sparingly, usually as a coating, at the last named locality.

**19** Hisingerite (*Hydrated ferric silicate.*)

In amorphous masses of an intensely black colour, with a conchoidal fracture.

In lode matter exposed in the lower tunnel of the Comstock Mine, Comstock District. (Mr. G. Waller, loc. cit.)

**20** Hornblende (*Bisilicate of various protoxides and peroxides.*)

The common black amphibole, containing aluminium, or paragasite, with the non-aluminous species tremolite and actinolite, have already been recorded (Catalogue of the "Minerals of Tasmania, 1896"), but there are several others occurring here which have not so far been satisfactorily identified.

At the Hampshire Hills a remarkably developed black amphibole occurs. It is in large crystals, which often reach several inches in length, and is closely associated with pyrophyllite and amethyst. In thin section under the microscope it is dark sombre green and yellowish-green according to the orientation. Intensely pleochroic $\mathfrak{c} = \mathfrak{b} >> \mathfrak{a}$. Extinction angle about 14°. Crystallisation irregularly prismatic and flaky, structure poicilitic, enclosing apatite, fluor, iron oxide, &c., and pierced with quartz grains; often surrounds felspar plates. Professor Rosenbusch, in a letter under date January 12, 1899, mentions this mineral as "a peculiar weakly bi-refringent monoclinic amphibole, bluish-green in colour; $\mathfrak{a}$ grey-green $\mathfrak{b}$ brownish-green, $\mathfrak{c}$ bluish-green to blue, 2 E (the apparent optical axial angle) small, optical character + and with strong dispersion of the axes. It recalls strongly the blue-green amphiboles of the crystalline schists in the Scora Vale, in the centre and north of Norway, and elsewhere."

The series of phonolitic rocks of Port Cygnet afford one and perhaps two species of soda amphibole, but their specific identification is attended with considerable difficulty. Many of the rocks referred to have been microscopically examined by Professor Rosenbusch, and that well-known authority, in a communication to Mr. W. H. Twelvetrees, refers to one of the hornblendes as being barkevekitic. This is the prevailing form which is seen in rock sections from the locality indicated. It is myrtle green in colour by transmitted light, and in the absorption $\mathfrak{b} > \mathfrak{c} > \mathfrak{a}$, in this respect appertaining more to kataforite, but differing in the pleochroism. In the fractures and joints of the elaeolite syenite from the same place a black amphibole is occasionally developed, having much the general appearance of arfvedsonite. It is usually plentiful, occurring as long narrow thin laths and aggregates, sometimes reaching a trifle over 2 inches in length; they do not shew terminations, but have an irregular brittle structure. Fragments examined under the microscope shew the substance to be green by transmitted light. It is apparent that the soda hornblendes at Port Cygnet differ in some degree from those recorded from similar rocks in better known localities, and that they require further investigation before they can be satisfactorily determined.

**21** HISTRIXITE *(Sulphide of bismuth and antimony.)*

This mineral occurs massive at several of the North-East Dundas mines, where it is classed under the common designation of "Fahl ore," a term applied to several very distinct minerals with the general physical characters of tetrahedrite.

**22** HYALITE (*Hydrated silica.*)

Occurs in cavities of a hard lode gangue in white to pale-green botryoidal masses. Locality: Bell's Reward Mine, Heazlewood.

**23** HYDROCERUSSITE (*Basic lead carbonate.*)

In one of the adits at the Hercules Mine, Mount Read, a white fluidal substance was observed in decomposed lode matter, which, on giving up its hygroscopic water, assumed a silvery-white appearance, and which under the microscope is resolved into very minute scales, but with little or no hexagonal structure. In all essential respects the substance agrees with this species as detailed in "Dana's System of Mineralogy," page 299.

**24** LEPIDOMELANE (*Potassium mica rich in iron.*)

Occurs in large sixsided tables, occasionally 1 inch in breadth, of a black colour, and highly adamantine. Transparent in very thin laminæ, shewing a beautiful emerald green colour. The crystals for the species are remarkably fine, and well developed; they are found aggregated together in association with a peculiar amphibole and quartz, and evidently form portion of a contact on the fringe of granite. Locality: Hampshire, near the old silver mine.

**25** PHLOGOPITE (*Magnesium mica with little iron.*)

"This mineral occurs on Section 5367-93M in hornstone, associated with very large bodies of magnetite and zinc-blende. It occurs in large hexagonal crystals, with a very perfect micaceous cleavage. The colour is light green, varying sometimes to greyish-brown." (Mr. G. Waller, loc. cit.)

**26** PYRARGYRITE (*Silver sulph-antimonite.*)

Ruby silver ore has recently occurred at several mines, notably at the Magnet, where it is not by any means rare in patches and blebs in close association with galenite. The mineral is sometimes surrounded by frondose and granular native silver, and the combination, needless to say, adds materially to the silver assay value of the ore. At the Mount Stewart Mine it occurs sparingly, and in small vughs little nests of micro-rhombohedral crystals have been detected, which are probably this mineral. At the Mount Farrell Mine it has been noticed embedded in galena; also at the Confidence Mine near Waratah, and at the Hercules Mine, Mount Read, it has been seen in micro-crystals attached to filaments of native silver. Reported to have been found at the Oonah and British-Zeehan mines at Zeehan.

The light ruby silver ore (proustite) is sometimes associated with the pyrargyrite; the latter appears to be the more often noticed, but the exact determination of the species has not been made in the majority of occurrences.

**27** Restormelite (*Hydrous silicate of aluminium and iron.*)

As at its original locality, Restormel Mine, Cornwall, this substance occurs as a coating on psilomelane and other manganiferous material. It is white to pale-greyish blue, sometimes almost a clear blue. The incrustation is invariably thin, but quite noticeable and distinct. Locality: The Comet Mine, Dundas.

**28** Silver (*Native.*)

Some extremely fine examples of this native metal have recently occurred in the carbonate lode at the Hercules Mine, Mount Read. The mineral assumes most attractive nests and layers of extremely fine wire-like filaments, often with fern-like expansions, commonly implanted on a glistening, pure white, fibrous cerussite. The occurrence is by far the finest of its kind hitherto found in this State.

**29** Turgite (*Hydrous sesquioxide of iron.*)

An iron ore with the general aspect of fibrous hornstone, with a red streak. Hardness = 5, 6. Locality: Blythe River.

**30** Xanthosiderite (*Hydrous sesquioxide of iron.*)

Found as an incrustation, often in silky needles of a bright red colour, but sometimes in the powdery form. Occurs in the lode on gossan and other gangue. Locality: Magnet Mine, Magnet.

# NOTE ON JACUPIRANGITE IN TASMANIA.

By W. H. TWELVETREES, F.G.S.

(Read September 14th, 1903.)

THE wonderful aptitude of the alkaline magmas for differentiation is strikingly exhibited by the nepheline rocks at Port Cygnet. The promontory at the Regatta Ground south of the jetty consists of a central spur of elaeolite syenite, varying into alkali syenite, a light coloured alkaline eruptive of the character called leucocratic by Brögger, or salic in the new American terminology. The margins, especially the southern one, consist of the dark elaeolite-pyroxene rock known as jacupirangite. This locality name was given by Derby in 1891 to rocks in Brazil occurring as differentiation products in association with elaeolite syenite, usually laminated in habit and intersected by small dykes of the latter rock. The nepheline-pyroxene varieties pass into magnetite-pyroxene varieties and the latter into nearly pure titaniferous iron. This ore is found in Alnö (Sweden) connected with elaeolite syenite.

Megascopically, the Port Cygnet jacupirangite is a dark, medium-grained rock, speckled with elaeolite, and glistening with small brilliant crystals of augite. Under a magnifying glass a little iron pyrites is visible. The colour of the rock grows lighter as it merges into elaeolite syenite. The specific gravity is 2.89. Microscopically, the respective quantities of augite and elaeolite present do not differ much. The augite is green, slightly pleochroic, $c : \mathfrak{c}\ 35^{\circ}$. The elaeolite is in large hypidiomorphic plates. Sphene in fair quantity in wedge-shaped crystals. Melanite garnet, which is characteristic of all the Port Cygnet eruptives, is not absent from this, and is occasionally rather plentiful. Apatite is present in the forms of prisms and grains. Magnetite is scattered grains. A little brown biotite. In order of quantity, the minerals are elaeolite, augite, sphene, garnet, apatite, magnetite, biotite.

Professor H. Rosenbusch, in mentioning that this is a quite typical jacupirangite, says that search ought to be made in it for the rare mineral baddeleyite (dioxide of zirconium), which has been found in a Brazilian occurrence of the corresponding rock.

Both Rosenbusch and Zirkel treat this rather peculiar class of rock as a modification of elaeolite syenite. Mr. H.

Stanley Jevons includes it in the family of ijolites (pyroxene-felspathoid rocks), presumably owing to its mineral composition. As a rule, however, ijolites are much poorer in titanic acid and iron than jacupirangite.

At Port Cygnet the rock cannot be called a geological entity. It does not occur as a dyke of later material invading the main mass of syenite. It may rather be interpreted as resulting from differentiation by progressive crystallisation, the marginal parts of the cooling mass receiving concentrations of basic oxides, while the centre was left more acid. The minor variations are interesting; thus, vein-like bands of elaeolite syenite may be seen ramifying in the jacupirangite, and the latter also occurs as segregation spots enclosed in the lighter coloured rock. The central portion of the magma naturally consolidated after the cooling of the periphery.

The concentrations of iron ore into which the Brazilian rock merges have not been noticed at Port Cygnet; in fact, our rock is not at all rich in magnetite or ilmenite. The augite, too, is evidently not titanic. The titanium in the rock would appear to principally reside in the sphene.

# NOTES ON SOME ADDITIONAL MINERALS RECENTLY DETERMINED, WITH NEW LOCALITIES FOR SPECIES KNOWN TO OCCUR IN TASMANIA.

By W. F. Petterd.

(Read May 16th, 1905.)

The present contribution to the mineralogy of this State is of somewhat unusual interest, inasmuch as it describes for the first time an apparently new compound, which, although of no commercial value, is of some scientific interest. It is in its way a humble congener of the more imposing crocoisite, for the occurrence of which, in such magnificent developments, this island has obtained a great repute among mineralogists in all parts of the world, but, like it, is simply of scientific importance.

The Lefroy meteorite, now mentioned for the first time, is, although of such remarkably small size, worthy of special note, and its detection in the prospector's dish adds another to the romantic discoveries of such objects from unknown space. The already long list of the different minerals recorded from time to time as being found in this State is still further augmented by the addition of no less than eighteen not heretofore published; respecting these concise notes are given. Several of these are of some scientific interest, and two or three would be of industrial importance if they could be discovered in sufficient quantity. Notes on additional localities for a few others which are already on record are given, with some remarks on peculiar features presented by some few others.

I have to record my obligation to Mr. J. D. Millen, A.S.T.C., M.S.C.I., Lond., metallurgical chemist, for so generously undertaking the analysis of Bellite and Hercynite, for without this work, especially difficult as regards the first mentioned, my task would have lost its most important features.

1 Barrandite.—(*Hydrous aluminium and iron phosphate.*)

Occurs as brown dull amorphous masses of small size, associated with vivianite, Lyndhurst, North-East Coast.

2 Bellite.—(*Chromo-arsenate of lead.*)

This extremely interesting and, it may be said, attractive new substance usually occurs in delicate tufts aggregated together, and velvet-like coated surfaces thickly lining and clustering in drusy cavities in somewhat soft iron-manganese gossan. The coated surfaces are often met with of reasonable size, and have been obtained covering several square inches of the gossan, more especially where vughs and fractures occur. More rarely bunches of galena are wholly or partially covered by the substance. It is often in crypto-crystalline incrustations, occasionally pulverulent, and more rarely in bunches of hexagonal crystals of almost microscopic dimensions. The largest crystals so far observed were but three millimeters in length, but the outline was sharp and very distinct. The crystals are of adamantine lustre, and a remarkably bright red to crimson colour. Minute acicular patches of crystals are common, and under the lens are perfectly distinct, and thus afford very fine microscopic objects of considerable attractiveness. The bright crimson colour of the general mass is very characteristic, and by this feature it is noticeable by the most casual observer, even when not directly interested in mineralogy. It sometimes occurs in aggregates of extremely minute needles, much like velvet, of a distinct and bright yellow to orange colour, and in this form it also occasionally coats somewhat large surfaces. Chromiferous cerussite and more rarely crocoisite and mimetite are intimately associated with it. Although so noticeable, the coating of the substance is usually of such extreme thinness that it was only with the greatest difficulty and by using the utmost care that enough was secured to make a complete analysis. This was undertaken by Mr. J. D. Millen, A.S.T.C., M.S.C.I., Lond., metallurgical chemist to the Mt. Bischoff T. M. Co. The following is the result:—

$PbO$ = 61·680 per cent.
$Cr O_3$ = 22·611 ,,
$V_2 O_5$ = 0·106 ,,
$P_2 O_5$ = 0·045 ,,
$As_2 O_3$ = 6·548 ,,
$Al_2 O_3$ = 0·012 ,,
$Cl$ = 0·516 ,,
$S O_3$ = 0·054 ,,
$Ag$ = trace
$Si O_2$ = 7·587 ,,

99·159

Moisture not determined. The hardness is 2·5; specific gravity approximately 5·5. Streak, pale yellow. Crystallographic system hexagonal. Before the blowpipe on coal it readily affords a bead of metallic lead with arsenical coating and odour. Imparts to salt of phosphorus bead in OF and RF a fine green, thus absolutely masking the reaction of $V_2O_5$ in the OF with this reagent. In the wet the reaction of $V_2O_5$ was only obtained with difficulty, following the method of Ohly (analysis of the rare metals). The powdered substance was mixed with sodium carbonate, then fused, and after the addition of potassium nitrate lixiviated with water, filtered, and the clear solution boiled with ammonium carbonate. Acidified with hydrochloric acid, and hydrogen sulphide passed through the filtrate, the precipitate gave arsenic and green solution. The filtrate with concentrated ammonium of equal volume and treated with hydrogen sulphide gave a black precipitate which on filtering the solution left a cherry-red solution = vanadium. This new mineral species has been named in compliment to my old and respected friend, Mr. W. R. Bell, the veteran prospector, whose exertion has done much to advance the mining industry of this State, and who moreover has always taken a great interest in its mineralogy and geology.

Locality—The upper workings of the Magnet Silver Mine, Magnet.

3 CLOANTHITE.—(*Nickel diarsenide.*)

A greyish white isometric nickel ore, remarkable for readily altering or sweating on the surface, when specimens are in a moist atmosphere, to the hydrated arsenate, which on giving off its excess of hygroscopic moisture apparently becomes annabergite. It occurs in limited quantity with other nickel minerals in the lower levels of the Long Tunnel Mine, Rocky River.

4 ENERGITE.—(*Copper sulpharsenate.*)

Occurs in limited quantity with other ores of copper. North Lyell Mine, Mt. Lyell.

5 ESCHERITE.—(*Basic calcium aluminium and iron silicate.*)

This variety of epidote appears to be somewhat abundant on the margin of the Upper Emu River, opposite the north-west shoulder of Valentine's Peak. The crystals are at times quite half an inch in length, but are commonly broken and decomposed. Flakes of molybdenite sometimes occur disseminated in the masses of the substances.

**6** GENTHITE.—(*Hydrous basic nickel and magnesium silicate.*)

Found sparingly on Pentlandite, near Trial Harbour.

**7** GIBBSITE.—(*Aluminium hydrate.*)

Forms a thin seam on what is apparently the wall of a copper-bearing lode. Clarke and Sice's Copper Mine, Blythe River.

**8** HELIOPHYLLITE.—(*Arsenate of lead with chlorine.*)

In small crusts lining druses with crystalline glimmering and wax-like surfaces. Comet Mine, Dundas.

**9** HERCYNITE.—(*Iron aluminate.*)

Occurs as fairly large lumps in tin drift. It is amorphous, dull, of a bluish black colour and fine granular.

Analysis by Mr. J. D. Millen.

$$\begin{array}{lcr} Fe_2O_3 & = & 46{\cdot}91 \\ CuO & = & {\cdot}005 \\ SiO & = & {\cdot}0892 \\ CaO & = & {\cdot}086 \\ Cr_2O_3 & = & {\cdot}049 \\ Al_2O_3 & = & 41{\cdot}69 \\ \hline & & 99{\cdot}37 \end{array}$$

Sp. gravity, 3·765. Hardness, 3·9. Locality, Moorina. (J. Rundle.)

**10** HYDROMANGANOCALCITE.—(*Hydrous carbonate of calcium and manganese.*)

Occurs as a soft pink substance which readily absorbs moisture, and is thus easily reduced to powder. Heazlewood Silver Mine, Whyte River.

**11** IRON.—(*Lefroy meteorite.*)

A small meteoric siderite was obtained by a prospector in testing a dish of alluvial drift for

**15** Niccolite.—(*Nickel Arsenide.*)
This ore has been obtained in small quantity near Trial Harbour, West Coast.

**16** Pilotite.—(*Hydrated silicate of aluminium and manganese.*)
An altered variety of actinolite, known as "rock cork." It occurs in felted fibrous masses of a pale grey to almost white, in considerable quantity east of the "Red Face" at the Mt. Bischoff Tin Mine, Mt. Bischoff.

**17** Plinthite.—(*Hydrous aluminium silicate.*)
An amorphous clay-like substance of a brown colour, with conchoidal fracture. Near Falmouth, East Coast.

**18** Pimelite.—(*Hydrated magnesium and nickel silicate.*)
As an incrustation attached to other nickel minerals. Near Trial Harbour, West Coast.

**19** Proustite.—(*Silver sulpharsenite.*)
At the Oonah Mine, Zeehan, this mineral, which is commonly known as "ruby silver," has been obtained in bunches of minute perfectly-formed rhombohedral crystals of remarkably bright red colour. They are implanted on cavernous masses of pyrites, and are readily detected by the contrast of colour. Under the low power of the microscope they form most attractive objects, the crystals being extremely sharp and distinct. They rarely exceed two to three millimetres in length. Minute crystals have also been noticed at the Magnet Mine.

**20** Pyrargyrite.—(*Silver sulphantimonite.*)
At the Magnet Silver Mine this mineral has recently been obtained in small but perfectly-formed characteristic rhombohedral crystals nestled in cavities in the lode gangue associated with galena and blende in the southern working of the mine. They are dull black in colour, due to tarnish, but readily give the bright red streak as well as the conchoidal fracture when broken. The mineral in its compact and investing forms is not by any means rare, but the crystals are extremely so; in fact they appear to be first detected in this state.

**21** Pyrostilpinite.—(*Silver sulphantimonite.*)

A rare ore of silver (containing 59.44 per cent. of ag) known as "fire-blende." It crystallises in the monoclinic system and is sometimes tabular, but its common habit is in imperfectly terminated sheaves or irregular bunches—like stylbite—but of almost microscopic dimensions. It is of a hyacinth-red colour, but is generally tarnished to an almost black discolouration. When free from discolouration it has an adamantine lustre and decided red streak. In minute vughs it may be detected in association with nests of small quartz crystals. When coating cleavages in its extremely silicious gangue it soon arrests attention by its peculiar habit of occurrence in radiating and irregular bunches, by which feature it may be known from proustite, although both have the same bright colour. Before the blow-pipe it fuses easily, giving off white antimonial fumes, and with soda affords a bead of silver. It occurs in limited quantity, but quite enough to make an appreciable difference in the bulk silver assays. Locality, the Long Tunnel Mine, Heazlewood. Associated with this is another silver mineral of an orange yellow colour with yellow streak. It affects a frondose habit, and is found in exceedingly limited quantity as aggregates in the cleavages of the gangue. It may be xanthoconite (a silver sulpharsenate, crystallising in the rhombohedral system), but the quantity is too small to make reasonably certain of its exact identification.

**22** Quartz.—(*Silicon dioxide.*)

Mr. D. A. Porter, of Tamworth, N.S.W., has recently drawn my attention to an interesting occurrence of this mineral in a specimen associated with freibergite. Many of the extremely minute crystals attached thereto are "left handed" and others "right handed," and many of these show besides the "W" and "Y" trapezoids the rhombic face "S." This habit has not been detected in larger crystals from the same locality. The Hercules Mine, Mt. Read.

**23** Scorodite.—(*Hydrous ferric iron arsenate.*)

This mineral was obtained by Mr. W. R. Bell in clusters of beautifully formed orthorhombic

This variety of epidote appears to be somewhat abundant on the margin of the Upper Emu River, opposite the north-west shoulder of Valentine's Peak. The crystals are at times quite half an inch in length, but are commonly broken and decomposed. Flakes of molybdenite sometimes occur disseminated in the masses of the substances.

**6** GENTHITE.—(*Hydrous basic nickel and magnesium silicate.*)

Found sparingly on Pentlandite, near Trial Harbour.

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Forms a thin seam on what is apparently the wall of a copper-bearing lode. Clarke and Sice's Copper Mine, Blythe River.

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In small crusts lining druses with crystalline glimmering and wax-like surfaces. Comet Mine, Dundas.

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Occurs as fairly large lumps in tin drift. It is amorphous, dull, of a bluish black colour and fine granular.

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Occurs as a soft pink substance which readily absorbs moisture, and is thus easily reduced to powder. Heazlewood Silver Mine, Whyte River.

**11** IRON.—(*Lefroy meteorite.*)

A small meteoric siderite was obtained by a prospector in testing a dish of alluvial drift for gold in 1904. Its weight is 3·328 grains. Specific gravity, 7·847. It has the characteristic pittings and crust of such objects, and is beyond doubt of meteoric origin. Locality, Lefroy.

**12** LEUCOPHANITE.—(*Silicate of calcium sodium glaucina with fluorine.*)

It would appear that this mineral, which has been hitherto overlooked, is fairly abundant at or in the vicinity of the Shepherd and Murphy Tin-Bismuth Mine, Bell Mount, Middlesex. It is closely associated with pyrite, both copper and iron, in the examples which have come into my hands. It crystallises in the orthorhombic system, with a constant hemihedral habit, and twinning is an occasional feature. The crystals are, as a rule, well-developed in clusters on the margin of a spheroid amorphous mass of the substance. They commonly average a centimetre in length, and are consequently recognised with extreme ease. The general mass presents a fairly uniform colour of a somewhat peculiar shade of olive green, with a vitreous lustre and glimmering reflection. The crystals are usually of a rather darker shade. A pronounced character of this mineral is that when heated it becomes highly phosphorescent with a distinct bright light, in which respect it resembles chlorophane. It is about 4 in hardness, with a white streak. To the petrologist this is a find of unusual interest, as the mineral is considered peculiar to the elœolite-syenites of Southern Norway, the classic locality for this remarkable series of rocks; and this has hitherto appeared to be its only recorded association. The indentification thus tends to show a wider distribution in this island of igneous rocks related to the varied complex so pronounced at Port Cygnet, and which have been fully described from time to time in the proceedings of this Society.

**13** MANGANITE.—(*Hydrous manganese sesquioxide.*)

In small bunches of well-formed crystals. Hampshire Silver Mine, Hampshire Hills.

**14** MINIUM.—(*Lead plumbate.*)

Obtained as small encrusting patches of the usual bright red colour in the superficial workings of the Long Tunnel Mine, Castray River.

**15** **Niccolite.**—(*Nickel Arsenide.*)
This ore has been obtained in small quantity near Trial Harbour, West Coast.

**16** **Pilotite.**—(*Hydrated silicate of aluminium and manganese.*)
An altered variety of actinolite, known as "rock cork." It occurs in felted fibrous masses of a pale grey to almost white, in considerable quantity east of the "Red Face" at the Mt. Bischoff Tin Mine, Mt. Bischoff.

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At the Magnet Silver Mine this mineral has recently been obtained in small but perfectly-formed characteristic rhombohedral crystals nestled in cavities in the lode gangue associated with galena and blende in the southern working of the mine. They are dull black in colour, due to tarnish, but readily give the bright red streak as well as the conchoidal fracture when broken. The mineral in its compact and investing forms is not by any means rare, but the crystals are extremely so; in fact they appear to be first detected in this state.

**21** Pyrostilpinite.—(*Silver sulphantimonite.*)

A rare ore of silver (containing 59.44 per cent. of ag) known as "fire-blende." It crystallises in the monoclinic system and is sometimes tabular, but its common habit is in imperfectly terminated sheaves or irregular bunches—like stylbite—but of almost microscopic dimensions. It is of a hyacinth-red colour, but is generally tarnished to an almost black discolouration. When free from discolouration it has an adamantine lustre and decided red streak. In minute vughs it may be detected in association with nests of small quartz crystals. When coating cleavages in its extremely silicious gangue it soon arrests attention by its peculiar habit of occurrence in radiating and irregular bunches, by which feature it may be known from proustite, although both have the same bright colour. Before the blow-pipe it fuses easily, giving off white antimonial fumes, and with soda affords a bead of silver. It occurs in limited quantity, but quite enough to make an appreciable difference in the bulk silver assays. Locality, the Long Tunnel Mine, Heazlewood. Associated with this is another silver mineral of an orange yellow colour with yellow streak. It affects a frondose habit, and is found in exceedingly limited quantity as aggregates in the cleavages of the gangue. It may be xanthoconite (a silver sulpharsenate, crystallising in the rhombohedral system), but the quantity is too small to make reasonably certain of its exact identification.

**22** Quartz.—(*Silicon dioxide.*)

Mr. D. A. Porter, of Tamworth, N.S.W., has recently drawn my attention to an interesting occurrence of this mineral in a specimen associated with freibergite. Many of the extremely minute crystals attached thereto are "left handed" and others "right handed," and many of these show besides the "W" and "Y" trapezoids the rhombic face "S." This habit has not been detected in larger crystals from the same locality. The Hercules Mine, Mt. Read.

**23** Scorodite.—(*Hydrous ferric iron arsenate.*)

This mineral was obtained by Mr. W. R. Bell in clusters of beautifully formed orthorhombic crystals of remarkably high lustre. They were of small size, pale green in colour, and almost translucent.

**24** SICILIOPHITE.—(*Silicified serpentine.*)
This peculiar altered substance is extremely variable in colour, and occasionally almost opalescent. Near the Long Tunnel Mine, Castray River.

**25** SMECTITE.—(*Hydrous basic aluminium silicate.*)
Obtained in patches of extreme softness almost gelatinous, but soon becomes somewhat harder. It has a metallic, almost silvery sheen. It separates into folice of extreme tenuity. North Lyell Mine, Mt. Lyell.

**26** STEARGILLITE.—(*Hydrous basic aluminium silicate.*)
A pale yellow to almost white substance with strongly conchoidal fracture, and slightly opalescent and smooth surface. Derby.

**27** STEPHANITE.—(*Silver sulphantimonite.*)
Brittle silver ore. It is black and dull in general appearance, with a black streak. Found in thin irregular patches, implanted on a silicious gangue with "fire blende." Long Tunnel Mine, Castray River.

**28** STIBICOLITE.—(*Hydrous antimony dioxide.*)
In limited quantity as a pale yellow pulverulent mass. British Zeehan Silver Lead Mine, Zeehan.

**29** TOURMALINE.—(*Boron aluminium iron silicate.*)
The variety zeuxite, which is rich in iron and of an intensely dark green colour, occurs in remarkably large felted masses at the Castray River.

**30** WURTZITE.—(*Hexagonal zinc sulphide.*)
A rare zinc mineral differing in crystallisation from sphalerite. It is hemimorphic in habit, and by that character it may be recognised when in crystals. Usually it occurs in columnar masses. Hercules Mine, Mt. Read, and Magnet Silver Mine, Magnet.

# PROPOSED PSYCHOMETER INDEX

DESIGNED AS AN AID TO THE

# TER DETERMINATION OF COMMON FUNGOID ILLUSIONS

AND OF THE

# COMPARATIVE VALUE OF MENTAL CONCEPTS.

BY R. M. JOHNSTON, I.S.O., F.S.S.

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### INTRODUCTORY.

a subject of the nature indicated as , it is desirable to avoid the very on mistake of at once launching he mazes of a complicated argument employing terms which are either ined, or are apt to receive different retations from different per-

e whole value of an argument often ds upon the exact definition of one o important terms, and where such are loosely applied and but vaguely stood, the outcome of discussion, so cted, must result in confusion of ent.

point around which the present nent hinges is the word illusion. By n is meant any error of sense, ption, memory, or representation, or dgment based upon these which erfeits reality.

one particular sense it is ad- d that the objective aspect of all ctive concepts is illusory; but, in ense, concepts, for the limited pur- of this arguument, are not regarded ungoid." For the purposes of the nt argument it is sufficient to con- urselves to the commonsense appre- n of phenomena, and to what are only regarded as realities of common . Thus limited we may define all erfeits of realities as illusions of onsense.

By reality is meant the opposite of counterfeit—e.g., the pictorial representation of the features of a person, scene, or thing is a counterfeit when not regarded as a symbol of the thing represented. Art has reached a high limit when it produces illusion. But the art of the modeller, sculptor, mechanic, or necromancer can only succeed under restricted conditions as regards healthily constituted minds, armed with the full complement of the ordinary sensiferous organs. Those who lack, or who are deprived of one or more of the essential normal senses, can never be certain of freedom from illusion.

It is by the sister or auxiliary senses that we continually—perhaps unconsciously—correct our impressions, or take "our bearings," so to speak. Deprive anyone of these natural auxiliary aids, or even weaken or render any of them artificially inoperative, and lo! the individual mind is a ready prey to all the illusions and disorders of sense and imagination.

The senses, however imperfect in the normal condition, are wonderful checks upon each other. Combined, they are the props of true knowledge and understanding. The most simple impressions are liable to be illusory if the particular sense concerned be weakened by disease or overwork. Render inoperative, or weaken at such a time the sister senses, and the strong commonsense appreciation of the real differences between orderly waking or primary concepts, and imagination, memory, dream, illusion, breaks down, or disappears altogether. In fact the conditions under which the insane are bound are then most closely realised. Let those whose inexperience may have led them hitherto to trifle with the full value of the natural guardians of our reason beware of this consequence when they would erect the illusions of the crippled senses into equality with the evidence of the combined senses when free and unconditioned and at their best.

Although in a waking state, and under ordinary circumstances, we may have within ourselves a tolerably clear and unmistakable standard of what is real and unreal, yet at times, and with relation to particular concepts, there may be produced a very gradual and subtle blending of the two.

Especially is this result apt to arise when the region of fancy is in its most active state.

### THE REGION OF FANCY.

There is something most mysterious and perplexing in the concepts of fancy. They flit before our minds in myriad shapes, moods and colors, without summons; change their humors as in a kaleidoscope before we can well define them; and finally vanish, but to appear again and again, under favorable circumstances, as at first. Many suppose that the world of fancy, automatic introspection, or imagination (clearly distinguished by the conscious mind in health, from what, for want of a better description, we may call "external perception") is only fully disclosed to our minds during sleep or in delirium. But this supposition is traceable to inattention or inexperience. The retrospect of memory, the poet's trance, and the air castles built by the waking dreamer gazing upon the burnished cloud or glowing ember, although allied creations lack the vivid tone development of those creatures and scenes of fancy which startle us in the horrors of nightmare, or elate us in our more exalted moods during sleep. But the waking state has also an undercurrent of fancy which in every respect is analagous to our concepts during sleep.

### UNDERCURRENTS OF FANCY EXPERIENCED DURING WAKING STATE.

During our active waking state, when the external world has its meximum effect, the senses are continually drinking in fresh concepts at their various portals, each sense interpreting its varied impressions with that order and consistency which distinguishes the character of external impressions or fresh concepts. The reception of these primary concepts, characterised by their greater intensity, eclipses the softer reflex echoes of the imagination just as the stars are blotted from our vision by the approach of the radiant sun. The reflective imagination is not necessarily reduced to absolute inactivity, but rather it is that to the imaginative listener the louder speaking voices eclipse the more feeble.

The ghosts of the waking state are clearly analogous to the horrid nightmare demons of sleep. Such horrid dreams may be produced artificially by wilful interference with the breathing of the unconscious sleeper. (See "Illusions," by James Sully, p. 126—International series.) Thus, disturb the breathing of the unconscious sleeper by placing a heavy fold of the bedclothes over the mouth and partly the nostrils. By degress his face flushes, the skin exudes a sweat, the limbs are aimlessly jerked about as if in distress, and at last it is so oppressive as to awake the unconscious object of our experiment, who immediately proceeds to relate that he has awoke from a frightful dream, wherein he vividly felt he was being suffocated by some monster of horrid shape who sat upon his chest and grasped his throat with angry claws.

But intense fear during the waking state may at times, with superstitious minds, produce somewhat corresponding distorted concepts. The young and timid whose minds have been saturated with the weird legends of the Scottish Highlands, are at times specially subject to the influence of such disturbing illusions when obliged to travel alone in the silence of the night through dismal glades of sighing pines and peopled by repute by ghostly shades. To such it is possible that the indistinct outline of a dead stump faintly shining by moonlight, the phosphorescent fungus, or even a curihaped nodding furze bush, to their erted but spell-bound gaze, may be ed into forms as unreal and horrid ose due to indigestion or other rence with the necessary vital ns during sleep.

imagination it would seem has the under expectancy, fear, or e pleasure, to order and magnify reflex groupings of images which with the simple state of fear, re, anxiety, and suchlike; but it has e power to be specifically accurate sistent, and thus it would seem to blind groping of a dim generic not of specific value like the con- ness of the undisturbed waking t its best.

any one in a quiet mood, as he is g before the evening fire, purposely he eyes, and, to increase the effect, he palm of the hand lightly over o exclude, as far as possible, the tive effects of external impressions. ll then find the images of Fancy ng apparently upon the view of in that strangely vivid, changing, rent evolving and melting away ter; and yet, withal, giving an y sort of impression that there is a and a natural sequence in the , forms, colors, and pictures, rapidly displace each other as he

se gleams which we are permitted he spectators of are not or are but under the control of the conscious The writer has frequently tested ct by personal experiment. On the casion he did so his own thoughts o a large extent impressed with the y of the Huon road through which d travelled that day. Although he sely tried to work into the unbidden and images which floated before his l vision, the form of a wattle tree in m, he found he was unable to order llusion in many wooded scenes that den would vividly evolve to his ous sense. One remarkable scene d to thrust itself unbidden, again gain, viz.:—a small rocky promon- crowned with a group of the ul she-oaks so common on the n of the estuary of the Derwent arina quadrivalvis.) In the shel- bay beneath this rocky cliff scene where he felt he was situated he could see distinctly the wave-ripples, and reflections of the sun's rays, together with a strange bright patch of sunshine which seemed to brilliantly light up the sea at its base. He tried to force a change by the attention of the memory to the romantic Huon scenes, but he found he could but slightly vary the sea cliff scene already described, the patch of light still forming one of its distinctive features. On other occasions he had no difficulty of picturing the wattle tree in blossom, but in every case he felt he was as much a spectator as one feels in sleep amidst the scenes of dreamland.

It is quite possible, therefore, that the proverbial moods of some people—the grave and the gay—may, to a larger extent than we are aware of, be colored by this unsuspected undercurrent of fancy during our waking moments.

My chief object in drawing particular attention to the region of Fancy is to show that under peculiar circumstances it is conceivable that its hidden reflex activities may surge up among the primary concepts of the senses, and thus be the origin of sense illusions even in the minds of those who are otherwise of a sound, healthy constitution. It is quite clear that these undercurrents of Fancy are distinct from ordinary concepts of memory, although it is not improbable that memory and fancy concepts are intimately related, and may powerfully act and react upon each other. The curious way in which a memory—say of a name which we at the moment in vain try to recall—bursts in unbidden soon after upon a foreign train of thought, is very remarkable, and it is therefore quite possible that through the hidden agency of active undercurrents of Fancy the dormant memory may be awakened.

Illusions, as regards simple concepts, are comparatively rare among sane persons, where all the senses are free or unconditioned and healthy. External or primary sensations of forms, colors, sounds, touch, motion, and such like, are for the most part readily distinguished from simulations of realities, even in some cases of partially impaired sense organs.

There are numberless circumstances, however, which readily tend to produce illusion in the minds of persons untrained and inexperienced. For example, persons strongly tend to believe in a second shouter, while, for the first time, they listen to a remarkable voice–echo. Similarly the untutored must also be strongly impressed at first with the illusory reality of reflected sight objects. Who, again, has not felt the powerful tactile illusion of duality in unity by crossing the finger tips—preferably the second and third—while with eyes shut pressing the surface of a round object, such as a marble or the tip of the nose; or the converse of this–unity in duality—in the pressure upon the skin of the body by the two adjacent points of a pair of compasses?

If in such cases the particular senses were not aided by the more extended experience of others, and by free comparisons and repeated trials in conjunction with the sister or complementary senses, we should all be subject to illusions to a much greater extent than we at present conceive.

Where, on the other hand, the senses are not merely unaided, but are crippled by conditions which are unfavorable for the reception of clearly-defined and undisturbed concepts, we may be certain, that as sure as the lowly organised fungi attack and destroy the more highly organised animal and vegetable forms whose vigor has abated, or whose tissues are diseased, so sure is it that fungoid illusions will batten upon and distort the judgment of all those whose hidden springs are poisoned at the source by conditions unfavorable to the formation of strong healthy primary sense concepts.

### COMMON FUNGOID ILLUSIONS.

The references to what have been termed "Common Fungoid Illusions" in this argument, are restricted to a few common types, and do not pretend to comprehensiveness. One or two types have been chosen which are particularly characteristic of our own race and age. It would be less difficult to bring conviction to most people with regard to the prevalence of gross illusions among lower races of men, or among people of a bygone age; for it is proverbial that errors of this kind are likely to be more correctly appreciated from the standpoint of an observer untrammelled by local influences.
refer, therefore, to the illusions
existing lower races of men, or to t
ancient times in regard to demo
witchcraft, astrology, epilepsy,
the shape of the earth and its posi
the solar system, and such like,
merely to show that the natural
ignorance is illusion of some ki
another. Illusions are sometimes mi
and like all organisms of a m
character, they are difficult to disti
from the surrounding conditions
which they take their shape and
There are many current illusions,
fore, which are only superficially di
from those of older times. They
clothed in a pseudo-science g
mimicry of the prevailing spirit
age; but, fundamentally, they, c
amination, will be found to pres
well-known features of the fungoid illu
which in all ages have been kn
prey upon weakness and ignorance.

### THE ILLUSIONS OF IDEA SYMBOL

The first examples under this di
refer to those "fungoid illusion
closely associated with all forms
outward expressions of the ideas
cially those related to the sound-sy
of articulated words, and those rel
the form, sight, or touch symbols
kinds of writing. Simple pi
representations being more natur
less liable to be illusory. Perhaps
has been subject to this form of il
so much as the present, and paradox
it may appear, there is good rea
believe that many of the so
"educated classes" are likely to be a
slaves to the myriad illusions
therefrom as are to be found amo
illiterate.

What we know, think, and fe
through what chains of previous
ledge we have arrived at our presen
dition can only be disclosed partia
others by means of idea symbols.
wardly we can observe a man laug
speak, sing, gesticulate, but even
we could enter and penetrate to
motest molecule of his brain we cou
by all our perceptive organs of
discern his actual feelings or thoug

If in ourselves there were
orderly and consistent connection
ordinary casual relation between

similar groups of such external symbolic sounds, forms, gesticulations, and expressions with our own concepts, thoughts, and feelings, we could not hope to understand others, or be understood by them. Laughter in another, e.g., might really in itself mean grief, did not such outward symbolic expression correspond with a similar causal relation between our own constant forms of outward expression and our inner real feeling which we have learned to designate by the word symbol —laughter. (See Lange's History of Materialism, Vol. II., 316.) To the inexperieced this analysis may seem trivial, but it is really necessary; for it will be disclosed presently how closed all forms of illusion by the intervention of word symbols, may, through mistaken interpretation, result in much unnecessary strife and confusion. For it logically follows that if any idea-symbol be used by anyone in an abnormal way, whether in ignorance, at random, or as a wilful misrepresentation, he is likely to produce a wrong conception in the minds of those who are in the habit of using the idea-symbol correctly.

### ILLUSIONS RELATED TO WORD SYMBOLS.

The form, color, intensity, and specific significance of actual ideas can never be closely approximated by the agency of words between persons whose capacities differ, or whose mental culture may happen to be at different stages of development.

Every cultivated person knows from experience that particular words or phrases related to complex ideas—although at first used familiarly in a general sense—come by closer study and wider culture to stand for a much broader, deeper, and clearer conception than that afforded by the insignificant seed idea which at the first stage was associated with the particular word symbol in this person's mind. It is at this stage where confusion is apt to arise in controversy between good, earnest men. Philosophers, too, find in this region their favorite battle ground. But as regards the latter, so long as distinctions remain unclassified, it is perhaps well that a wisely conducted conflict should be maintained; for it is in such conflict that we come to expand the new idea, and to form the needful expression. The ignorant person, as well as the superficial word glutton, so largely produced by our gramaphonic systems of education, only catch remotely the order of genus of the cultured thinker's idea. To the class referred to—the Species, or the fully developed light and shade of the cultured person's idea is more or less concealed in penumbral darkness. The illusions which arise out of these differing conditions, however, are often very disastrous; for to these may chiefly be attributed the reason why the prophets of each succeeding age have been stoned, crucified, maligned, or otherwise maltreated. The fungoid illusions which batten upon forms of expression have been the cause of much evil. That the evils arising out of word illusion is not exaggerated may be easily proved. Let anyone attempt to get a clear grasp of the ideas of any two persons of average education with respect to the real nature and particular meaning of the following group of idea symbols as used by the learned, viz.:—

Anthropomorphism, Atheist, Christian, Communist, Deist, Darwinian, Determinism, Evolutionist, Hypnotism, Paganism, Pantheism, Realism, Sceptic, Socialism, Teleologist, Spiritualist, Agnostic, Mind, Force, Matter, Spirit, Soul, Body, Ego, Non-Ego, Religion, Moral sense, Will, and suchlike.

These terms cover a very wide field. They are in common use in some sense by the learned and unlearned; by the learned of opposing schools of thought; but as there are comparatively few who take the honest trouble, or have the mental capacity to understand in their fullness the history and complex ideas underlying these words or symbols, it follows that they must be fertile sources of illusion; and the fruit of such illusion, where strong feelings are concerned, have been, and ever will be, confusion, bitterness, and strife. The proof of this is manifested by the frequency of the use of terms ending in *ist*; not so much as an expression of the appropriate underlying thought or feeling, as of a dim notion of a quality involving reproach and depreciation. Clearly to all such the particular term is illusory; and the application, so far as intention is concerned, is likely to be as false and unjust as when at Antioch, the fierce opponents of the followers of

Jesus Christ, coined the term of reproach "Christian," now fortunately transmuted into one glorious to humanity.

As a further illustration of the common illusions related to word-symbols, let us examine the illusory conceptions so frequently held by many persons with regard to the use of the terms Matter and Mind. The illusion to such persons is, that we know directly a substance of matter as distinct from mind. And again further it is conceived by such persons that matter, in itself, is dead, inert, distinct from, and less mysteriously constituted than that part of mental phenomena to which they restrict the term mind.

This is a common fungoid illusion. The cultured thinker knows and can demonstrate logically that the substance of matter is a hypothesis of the mind to account for certain of the mental concepts chiefly related to direct primary impressions of sight, touch, and muscular effort. It can be demonstrated to minds sufficiently developed to receive such demonstration that all our concepts—whether relating to form, color, space, time, resistance, opacity, transparency, smell, heat, cold, hunger, thirst, weariness, memory, mental introspection, self, not self; in a word, all sensations are mental. In the words of an able expositor (Huxley) immediate knowledge is confined to states of consciousness, or, in other words, to the phenomena of mind. Knowledge of the physical world, or of one's own body, and of objects external to it, is a system of beliefs, or judgments, based on the sensations. The term "self" is applied not only to the series of mental phenomena, which constitute the *ego*, but to the fragment of the physical world, which is their constant concomitant. The corporeal self, therefore, is part of the *non-ego*, and is objective in relation to the *ego* as subject.

Elsewhere the same able expositor states clearly, "that if we possessed no sensations but those of smell we should be unable to conceive a material substance. We might have a conception of time, but could have none of extension, or resistance, or of motion; and without the three latter conceptions, no idea of matter could be formed."

It may be conceived, therefore, that the only knowledge we consciously possess, directly or indirectly, is purely mental. One portion we call external perception; other parts (including feeling, judgment, memory, dream, delirium, illusion—all parts of one whole) purely subjective, and equally mysterious. The mind tends to infer, ejectively, its impressions, as symbolic of a mysterious objective, something external to it. That is all.

The Æolian harp, if endowed with the sense of hearing only, and so limited to the range of its own chord sounds, would conceive its own chord, objectively, as external to itself. It would tend to seek external to itself the exact origin and idea of its own specific sounds. It could not dream, as the objective cause of its own subjective chord sounds, the gentle vibrating breeze, except in the manner of some Æolian harp sound.

### THE COMMON ILLUSION THAT MEN OF CULTURE AND SCIENCE HAVE A SPECIAL TENDENCY TO BE SCEPTICAL AS REGARDS TRUTH.

This may be regarded as a type of the many fungoid illusions which naturally arise in the prejudiced and antagonistic minds of the slothful and ignorant.

Lovers of ease favor conceptions which involve no trouble of mind. To hold the mind in suspense when in doubt, and when immediate action is not imperative; to sift the grain of wheat from the associated chaff; to qualify the observation with the ascertained knowledge of one's personal equation of error; to seek truth with a single eye in scorn of cowardly fears regarding possible consequences to one's self; to suffer misunderstood the mental pain of transition of thought due to the unequal growth and change of the intellect and one's personal clinging ideals and sympathies, are matters which are no more than the sound of words to the indolent mind, whose faith, too often, is a mere accident of time and place. The indolent mind is irritated by complexity, and insists upon the enjoyment of simplicity, even though it should be artificially created by the mutilation of valuable complex truths.

It is not here maintained that the earnest enquiring mind is not advantaged at times to desire when wearied a somewhat similar refuge. But to the latter it is consciously sought, and is the well-earned repose after the strain of mental toil. In their case it is the natural half-sleep following upon mental activities wherein at times the great and beautiful generic truths of poesy and parable have their birth. It need not be pointed out, however, that there are many indolent of mind amongst us, while the group of earnest and thorough thinkers are few. It is not surprising, therefore, that the aims and methods of the scientific worker should so frequently be misunderstood and misrepresented.

Of course it is not meant that the opponents of scientific work and methods of investigation are so unjust as to suppose that the alleged tendency to scepticism, on the part of the men of science, would be blameable in matters which are false or which appear to be so; for in such case there would be no room for discussion.

To oppose even the appearance of falsehood or vice is a healthy attitude, and can only be considered objectionable by those minds antagonistic to truth and virtue.

As a matter of fact, the charge as regards scientific observers is manifestly absurd. Science is simply carefully proved knowledge. True men of science are those who are ever actually engaged in wresting the fruits of knowledge from the vast unexplored regions of nature, and whose highest reward is the feeling that, by their labors and discoveries, they have conquered some part of the region of chaos, doubt and obscurity, to the great benefit of their kind. The railway train in rapid motion may cause the illusion that the increased resisting current of air is in itself moving more swiftly than when the same train is at rest.

In like manner inexperienced minds see only in the active forward advance of scientific investigation, the sifting, weighing, and measuring processes, and often labor under the illusion that because in this pioneer work the workers are obliged to reject large quantities of truth husks, the latter process—and not the acquirement of the fewer and less conspicuous truth grains—is the particular object of their remarkable activities. Their positive advance, and greater need to discriminate and to reject, being a mere consequence of their relatively greater love for the acquisition of more truth or knowledge. Relative to the indolent they appear to reject more—nay, blunder more—but it is altogether due to the fact that their love for knowledge is more active. Those who can endure an imperfect mixture, or do not love purity, need not reject much dross; but it is hard that the refiner should be blamed for the unavoidable accumulations of the conserving and refining processes.

### ILLUSIONS DUE TO INEXPERIENCE OR DEFECTIVE EQUIPMENT ON THE PART OF THE ACTIVE OBSERVER.

Thoughtful men are well aware of the danger of being over-sure about matters which many able men have arrived at profoundly opposite conclusions. The thoughtless have no such dread. And yet, though all our observations are so apt to be faulty if not properly directed, few think that for exact observation in any special branch of knowledge, special aptitude, and a long, careful training in the instruments of observation are absolutely necessary. For example:—Look what long years of patient training of the muscles of the hand, ear, and eye, is necessary before the musician can render with skill and feeling the masterpieces of a Mendelssohn or a Schumann. The skilled botanist may be called upon at any time to distinguish a new plant, and to describe its characters. But in order to do this satisfactorily he must be prepared to show in what respect it is related, and in what respect it differs from, say, about 85,000 flowering plants already scientifically described and classified. When we learn also that prior to the proper study of botany and zoology, the student, by laborious training in morphology and physiology, must equip himself for the special work, we can have some notion of the pains taken by men of science that observations, in the line of their studies are not marred by lack of skill or of previous training. Nay, so necessary is it that all scientific observation should be carried out with the greatest rigor and exactness, that the greatest pioneers in scientific investigation have been the foremost in the discovery of more perfect instrumental aids designed to further extend the range and neutralise the errors of our senses, and in this way secure that precision which modern science demands of its followers.

It takes the great expositor and thinker, Lange, over 1000 closely printed pages of matter, to unfold to us a mere abstract of the history and meaning of the schools of materialism and idealism. Bastian, with numerous carefully executed figures, tries to convey to us in 700 pages of descriptive matter a summary of his own observations regarding the structure and functions of the brain. Hitzig, Ferrier, and other skilled specialists, had long and profoundly studied the functions and physiology of the sensorial apparatus of the brain in all its bearings, and their combined testimonies have been of the greatest service to us in dissipating many of the older and cruder conceptions of phrenology and physiology, and in explaining many of the more mysterious problems of mind and body.

One important lesson has been given to us in regard to observation, which has an important bearing upon the subject of this argument, viz., that not only as regards eyesight and for astronomical observations merely do we require to provide ourselves with a carefully determined "personal equation of error," but every other sense should be similarily guarded as they are all subject to varying degrees of error under certain conditions. From what has already been stated it is obvious that should any untrained person think he can properly understand the mysteries of new and complex phenomena, without first studying carefully the laws which make phenomena at all possible to him, together with the ascertained conditions of sensorial error, he will undoubtedly and unconsciously land himself in the Cimmerian darkness of illusions, kindred to the ancient witchcraft or its twin sister, spiritualism, now so often guised in modern pseudo-science dress.

To the cultured thinker all phenomena are purely mental and subjective, and as such are equally mysterious. To the average spiritualist only a small portion of phenomena, and that the most disordered and unreliable part seems to be regarded as possessing any wonder or mystery. The most orderly, valuable, and equally mysterious part of subjective phenomena—orderly primary concepts—is despised by the spiritualist for the vulgar reason that such orderly manifestations are as common as the green grass; and yet the profoundest thinkers see in the lowliest organism so common by the wayside a mystery greater than that of human folly, whose epidemics have so often puzzled the moralist and psychologist.

Whilst dissecting the living tissues of the common triglochin and other weeds of our ditches under the microscope, I have often been impressed by the beauties of structure which are shut off from the feebler powers of the unaided eyesight. I have watched the mysterious life of the cell in the humble yeast plant and desmid, and I have seen the living building processes grow into form and beauty before my wondering sense, and a feeling of awe has frequently filled my mind, as form after form seemed to come mysteriously into existence before my eyes, and to frame themselves upon a structure of wondrous design and beauty. Each living "brick" in itself being guided and determined in its course as if by the immediate agency of a hidden Almighty finger.

Most naturalists have been similarly impressed while contemplating the silent building forces of organic nature. They are thus frequently reminded of the mystery underlying the more familiar and perhaps uninteresting externals of common objects. They are also so accustomed to witness mysterious design and movements for which they can give no explanation that they are not so apt to be led into illusion by the appearance of phenomena, which, for the time being, may seem extraordinary and unexplicable to the crippled or unaided senses. Nor are they so apt to be overwhelmed by mere novelty or rarity because the momentary wonder seems as inexplicable as the origin of all mental phenomena to the cultured thinker. The average form of spiritualism would appear to be a corrupt or degraded form of the poetry of Materialism, although it affects to despise that system of philosophy. It is far from my mind to treat with levity the ordinary crudities so commonly manifested at the many spiritualistic seances which I have had the opportunity of witnessing.

One grave objection to the value of the testimony of such seances is, that wherever any phenomena have been observed which appeared to be inexplicable, they were always manifested under conditions where at least some of the complementary senses, if not all, were at a disadvantage. It has already been stated that the senses are particularly liable to all forms of illusions, at times, even where they are free and unconditioned. It has also been shown that the only difference between the waking concepts, dreams, subjective delusions, and such like is in the invariable strength, and unmistakable order, consistence, and harmony of the primary concepts, as compared with the feebler, inconsistent, shifting, kaleidoscopic phenomena of fancy, ghost delusion dream, and other illusions of the diseased brain. The only way to distinguish any form of illusion would be to dispel the conditions unfavorable to the manifestations of healthy concepts.

One significant circumstance which may enable strong healthy minds to free themselves from the degrading errors of spiritualism is to discern that the conditions favorable to illusion and fraud are ever the conditions under which typical spiritualistic phenomena are manifested. Lord Lindsay and others—by moonlight—fancied that they saw the law of gravitation opposed by some new force, in the devitation of Mr Home. But that men, in a sane state of mind, should accept the idea offhand that they had discovered a new force when all the senses were so absurdly handicapped (for ordinary purposes of observation even), and that they were trammelled by the disadvantage of best position for verification, shows, for the time being, they were not aware of the great liability to illusion under such conditions.

To have contemplated even the possibility of discovering a new force under such crippled conditions shows that their minds, like those of ordinary madmen, were for the time being constituted to favor illusionary conceptions.

It ought to be strongly impressed that there is no well marked line between the sane and the insane, and scarcely any where illusion is concerned, apart from its permanency.

There are many remarkable points of agreement between some of the concepts of spiritualists and those of the hopelessly insane.

1. In both the concepts are frequently normal, in contradiction to common sense, and without any apparent purpose or reason. The intensity of the conviction, nevertheless, in both seems to be greater than the ordinary convictions of common sense.

2. They manifest themselves under conditions where the common organs of sense are partly or wholly crippled.

3. In both classes they are manifested frequently under physical excitement or strong emotion.

4. In both they are frequently manifested by people who have, or who appear to have, a well-known epileptic tendency, frequently resulting in bodily prostration.

5. The moral sense of many such intermittently affected epileptics—the trance medium—seems to be very low, and their testimony worthless.

It is a significant circumstance observed by Dr. Maudsley, and other experts, that in the incipient stages of epilepsy, the destruction of the moral sense seems to precede the more violent physical accompaniments of this dread calamity.

6. In both classes referred to extreme excitability is frequently exhibited; their imagination and originality remarkable, and often of a poetic order. But, unlike the normal stages of sanity, they are extremely irritated when the reality of their illusory concepts are called in question. It would seem as if all the creative and other powers of the mind were diverted from critical and other proper uses, and devoted to the creation of wonderful theories, whose sole object is to buttress or build up the loved illusion.

The explanation of spiritualism is not to be found in the typical phenomena, but in the thorough study of the deeply rooted causes, mental and physical, in men's natures, of which the phenomena which so impresses them are a fairly reliable index. Tell me a person's wonder, and I may fairly infer whether the intelligence of the person is of the order of a madman, a savage, a child, or a Newton.

Wonder is purely a relative state, and varies with the stage of intelligence. Higher intelligence is like a kingdom of a higher order of useful vigorous plants, whose advance into a wilderness absorbs and takes the place of a less useful and a more lowly order.

The mystery which caused the deep agitation of Newton's mind as influence which binds the Pleiades, gradually dawned upon his wondering soul, is a very different one from that which fascinates the gaze of the ignorant trick-worshipper.

To penetrate the interior of a world in motion; to trace as far as possible the orderly laws which determines its course, and to contemplate the mystery of the cause of its original impulses are matters which lie within the field of wonder of the higher intelligence. To be callous to the inner life of everything, to see a wonder only in novelty, rarity, or in the unusual exterior are sure indices of a lower stage of intelligence.

### CONCLUSION.

The order and equilibrium of the mind are intimately connected with the vigour, fulness, and health of the organs of sense.

Many persons commit mental suicide for the sensual delight of a useless momentary wonder.

The insane, by disease, are forced to live always within a world of wonders such as those sought after, at times, by the ignorant.

I have prepared a classified "Psychometer Index" which to some may be useful in showing the treacherous nature of the apparent value of judgments based upon observations of the crippled senses. I have shown by this classified "Psychometer Index" that we may only hope for orderly concepts, free from illusion, within narrow limits. Beyond this limit orderly conception diminishes or lessens in value. It would seem that passion distorts or gains ascendancy over sane judgment in proportion to the degree of the diminishing power of the senses, until, approaching the zero of the understanding, the state coincides exactly with insanity.

The insane state consists of all kinds of unreasoning beliefs; but, unlike sane concepts, they are marked by a real pitiful intensity of conviction to which the sane mind can never hope, or ever wish for, within the logical order of the higher states of consciousness. Better be a dull, pulsating mass of protoplasm than to be adrift upon a stormy ocean of disordered concepts, when the rudder and helm of the senses have been rendered nugatory, or have been for ever destroyed. Let us beware, therefore, of the intensity of a conviction which is, in this way, related.

Notwithstanding what has been stated in opposition to illusions of a fungoid character, I am far from being convinced that *all* illusions, as such, are harmful. I am inclined to think that a benefical purpose is served by many of them, especially of such as are born of the extraordinary strength of love, affection, sympathy, and the higher poetic fancy. The mother, for example, sees favourable qualities in her child which no other eye regards, and, frequently, have no real existence. Who, therefore, would wholly banish the mist of the affections? I, for one, would not if I could. A large group of illusions might fairly be classed under this order. All illusion, or partial illusion, which for the moment may be necessary to our comfort and well-being, spiritually, and not liable to introduce more remotely great evil consequences, I would be sorry to see wholly dispelled. I do not regard or class such as "Fungoid Illusions." Illusions which are harmful are alone regarded as "fungoid" in my estimation.

We have seen that it may be possible to reach the zero of valuable concepts, and, indeed, of all consciousness, in two widely different directions. On the one hand, it may be gradually approached through varying stages of fictitious wonder, imagination, dream-illusion, insanity, and by the destruction of one after the other of those wonderful organs of sense which, though of feeble range, are yet, in the highest sense, God-given, Heaven-born.

On the other hand, by humble mien and fearless confidence, we may, through all the channels of widening sense, advance to still greater heights, wider horizons, which may be ordained that we should yet conquer. There are still almost infinite circles within the legitimate domain of natural science, but beyond the limits of our present knowledge and range of powers.

Yet, even now, from a thousand heights of sense, we can perceive that, however we may increase in *subjective* knowledge —*i.e.*, natural knowledge—the *objective* mystery which surrounds us, which we feel we can never penetrate, is but increased by every advancing step in natural knowledge. We feel that though new chords should continue to be struck on "the harp of a thousand strings," the "Everlasting Arm" which is the cause of their harmonious vibrations can, itself, never be revealed to us save through that veil of the sensible in which "we live, move, and have our being."

Do not, therefore, foolishly tremble under the illusion that all mystery shall be dissipated, or that the veil may be pierced, if we but open wider our dim eyes, or stretch out a little further our feeble hands. Their limits—not determined by us—not written on tables of stone, and soon enough reached—are the truest and best guides. The created mysteries of distorted imagination and the crippled senses are but a poor "mess of pottage" as compared with our glorious birthright of *orderly* natural knowledge and feeling.

If still—like wilful children—we *will* have a deeper mystery, let us, with the fullest possible equipment, attempt to penetrate from every portal of sense the CAUSE of which they are themselves wondrous symbols. The effort to do so will convey an impression which *cannot* be effaced. Thereafter the appalled and humbled mind will gratefully shrink back within its own protecting luminous mist of the higher poetic ideal, and, with the chastened submission of a child-cry—

> "It is enough." "Thy will be done."
> Nor swords of angels could reveal what
> they conceal.

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### Proposed Psychometer Index Designed as an Aid to the Better Determination of the Comparative Value of Mental Concepts.

Table specially prepared with the object of showing approximately the Relative Value of Observations and Related Conclusions or Judgments, as Determined by the Nature of the Testimony and other Conditions under which the Original and other Observations have been made;—

| Key to Classification. | Order of Value of Testimony. Direct. (1) | (2) | Indirect. (3) | (4) |
|---|---|---|---|---|
| (A) Phenomena of the Waking State— | | | | |
| (A) Mind not diseased and little or not affected by the disorders arising out of passion, prejudice, or ignorance. | | | | |
| ° Common Phenomena:— | | | | |
| Condition *a* ... | 1 | 2 | 3 | 4 |
| " *b* ... | 5 | 6 | 7 | 8 |
| " *c* ... | 9 | 10 | 11 | 12 |
| " *d* ... | 13 | 14 | 15 | 16 |
| " *e* ... | 17 | 18 | 19 | 20 |
| " *f* ... | 21 | 22 | 23 | 24 |
| " *g* ... | 25 | — | — | — |
| ** Extraordinary Phenomena:— | | | | |
| Condition *a* ... | 26 | 27 | 28 | 29 |
| " *b* ... | 30 | 31 | 32 | 33 |
| " *c* ... | 34 | 35 | 36 | 37 |
| " *d* ... | 38 | 39 | 40 | 41 |
| " *e* ... | 42 | 43 | 44 | 45 |
| " *f* ... | 46 | 47 | 48 | 49 |
| " *g* ... | 50 | — | — | — |
| (B) Mind not diseased, but more or less subject to the disorders arising out of passion, prejudice, or ignorance. | | | | |
| * Wonderful or Miraculous Phenomena, including the Ghost, Vision, or Illusion stage:— | | | | |
| Condition *a* ... | 51 | 52 | 53 | 54 |
| " *b* ... | 55 | 56 | 57 | 58 |
| " *c* ... | 59 | 60 | 61 | 62 |
| " *d* ... | 63 | 64 | 65 | 66 |
| " *e* ... | 67 | 68 | 69 | 70 |
| " *f* ... | 71 | 72 | 73 | 74 |
| " *g* ... | 75 | — | — | — |
| (C) Mind diseased, and subject, more or less, to all its disorders. | | | | |
| Condition:— | | | | |
| * Hallucination, milder form... | 76 | 77 | 78 | 79 |
| ° Dementia ... | 80 | 81 | 82 | 83 |
| (B) Phenomena of Sleep— | | | | |
| (A) Peaceful or pleasurable visions ... | 84 | 85 | 86 | 87 |
| (B) Painful or horrible visions ... ... | 88 | 89 | 90 | 91 |
| (C) Profound slumber... | 92 | — | — | — |

## EXPLANATION OF TERMS USED IN CLASSIFIED TABLE.

**Subdivisions of order of value of testimony :—**

(1) Indicates tetimony directly appealing to senses, feeling, or consciousness. Memory of former experiences aiding the judgment.

(2) Indicates testimony directly appealing to the senses, feeling, or consciousness. Memory of former experiences not an aid to judgment.

(3) Indicates experiences more or less remote. Testimony dependant upon observer's memory mainly.

(4) Indicates that testimony is wholly dependant upon the observation of others—not personal observation.

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Conditions *a b c d e f g* qualifying the value of the subordinate stages of observation :

*a* Indicates stage of the scientific method. All sense organs available for verification, together with the advantages of health, perfect organisation, best position, special training, and full equipment of tested instrumental aids.

*b* Indicates the common sense stage. The same as *a* stage, but lacking the advantage of special training, best position, and the absence of tested instrumental aids.

**(Crippled sense stages more or less liable to illusion.)**

**_c_ Indicates the _b_ stage, but lacking the co-operation of one of the least valuable of the complementary sense aids.**

**_d_ Indicates the _b_ stage, but lacking the co-operation of two of the least valuable of the complementary sense-aids.**

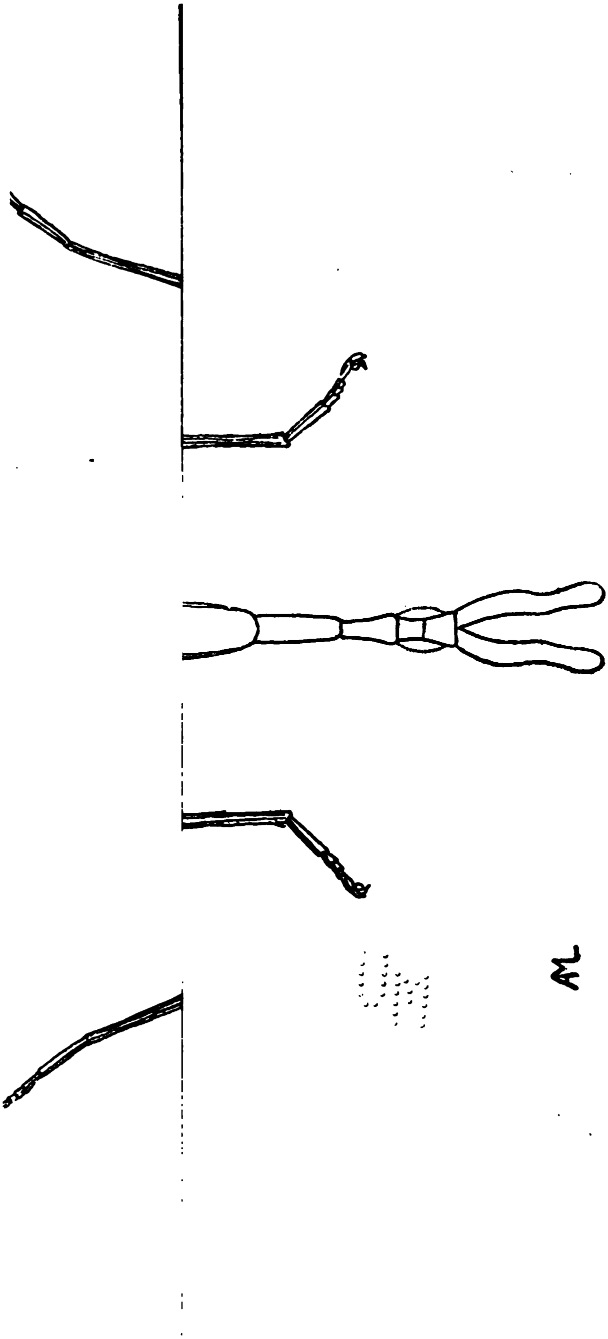
**_e_ Indicates the _b_ stage, but lacking the co-operation of three of the least valuable of the complementary sense-aids.**

**_f_ Indicates the _b_ stage, but lacking the co-operation of four of the least valuable of the complementary sense-aids.**

**_g_ Indicates that all the sense organs are rendered nugatory so far as direct observation is concerned; memory of former experiences alone available to qualify the testimony of others upon whom the crippled mind and senses are now wholly dependant.**

Column numbers under order of value of testimony :—

The numbers under each one of the four columns indicate, in the order of downward sequence, the relative qualitative (not quantitative) value of the particular stage of observation, or of the conclusion or judgment based thereupon.



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EXPLANATI
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# THE ETHICAL AND ECONOMIC ASPECTS OF OLD AGE PENSIONS.

By R. M. JOHNSTON, I.S.O., F.S.S.

(Read November 22, 1905.)

## INTRODUCTORY OBSERVATIONS.

The whole question of making State provision for the maintenance and support of all helpless and infirm persons who have survived the age of 65 years is too often, in controversy, clouded by the frequent use of the abstract term "State," as if it represented, in itself, a real, distinct, and independent entity.

The provision for the maintenance and support of all dependents of the community in any one year — whether children, helpless invalids, improvident persons, or the aged infirm — is purely an economic question, and depends, not upon an ideal State, but directly and entirely upon the products and services created or supplied by the independent active breadwinners of the community for the time being. Nay, more; every function of the State, as such, which absorbs time and labour, directly or indirectly, by means of general taxation, is wholly maintained by the usefully and intelligently directed services of the active breadwinners of the community for the time being.

It will be observed that much stress is laid upon the phrase, "the active breadwinners of the community for the time being," for it will be made apparent hereafter that the whole argument in favour of Old Age Pensions, both from an ethical and economic point of view, rests upon the fact that the active independent breadwinner of to-day has been a dependent infant and school-child in his earlier years, and he may yet in his old age become one of the helpless and infirm dependents upon the younger generation of breadwinners whom he, in his prime manhood, and during their helpless stage of infancy and childhood, directly or indirectly through State agency, sheltered, educated, and maintained.

## THE COMPOSITION OF A NORMAL POPULATION.

A normal population in a civilised State at the present time consists of:—

1. Independent breadwinners.
2. Semi-independent wives and other relatives engaged in the domestic duties of the household.
3. Dependent children, and helpless and infirm relatives.
4. Friendless and helpless poor, young and old, maintained by breadwinners through the medium of State taxation.

The following abstract, taken from the analysis of "Occupations of the People" in Tasmania at the last census, affords a clearer notion of the character and relative number of these important groups per 10,000 of the population:—

Composition and Relative Proportion of the Four Great Divisions of the People.

(Per 10,000 persons.)

### (A.) INDEPENDENT BREADWINNERS.

| | | |
|---|---|---|
| (a) Rendering personal and immaterial services for express salary, commission, or wages:— | | |
| Professional services ... ... ... ... | 290 | |
| Domestic services... ... ... ... ... | 460 | |
| | | 750 |
| (b) Rendering material services for equivalent value in salary, commission, or wages:— | | |
| Distributors of materials... ... ... | 716 | |
| Modifiers of materials ... ... ... | 1,088 | |
| Primary producers of materials ... | 1,617 | |
| Other independent services ... | 90 | |
| | | 3,511 |
| Total independent breadwinners | | 4,261 |

### (B.) SEMI-INDEPENDENT GROUP.

| | |
|---|---|
| Wives and others engaged in domestic duties of the household, but not receiving an express equivalent in a monetary form | 1,946 |

### (C.) DEPENDENTS.

| | | |
|---|---|---|
| (a) Maintained directly by breadwinner:— | | |
| Children under 15 years of age | 3,650 | |
| Aged and infirm parents 65 years and over | 35 | |
| Helpless relatives 65 years and over | 7 | |
| Ditto ditto, under 65 years | 10 | |
| | | 3,702 |
| (b) Maintained indirectly by breadwinners through the medium of State taxation:— | | |
| Paupers and others 65 years and over | 29 | |
| Ditto ditto under 65 years | 62 | |
| | | 91 |
| Total dependents upon breadwinners | | 3,793 |
| Total persons | | 10,000 |

From the preceding tabular analysis it will be seen that there are only about 42 persons in every 100 who can be regarded as making independent provision at any time for their own maintenance by means of direct industrial services having an express monetary exchange value in the eyes of the economist.

The members of the houshold who perform the necessary domestic duties, although not receiving any express remuneration from a monetary point of view, may be also regarded as self-supporting, as they, by their services within the family, give a value equivalent to breadwinner, although not in a money form.

It will be seen that every 42 breadwinners maintain, on the average, 36 dependent children under the age of 15 years, who have up to this age been recipients of the products created by the labour of breadwinners in the aggregate for the support of the whole population, and who, at this stage, had never contributed anything towards the burden of the State's maintenance.

In addition, these 42 breadwinners, directly or indirectly, support the equivalent of 0.71 helpless dependent persons over the age of 65 years, and 0.72 dependents under this age, the greater part of whom had been breadwinners, and who for 25 years at least had not only maintained themselves by their own industry, but had on the average taken their fair share — during their own prime and active stage of independence — in the maintenance and support of 38 helpless young and aged dependents. It will be seen, therefore, that while the young and helpless forming 36.57 per cent. of the population have only an ethical claim upon parents and the State for care and maintenance, and education ; the deserving aged breadwinners who are past work, aged 65 and over — and only forming 1.28 per cent. of the population, and about 38.73 per cent. of the group 65 years of age and over — have both an ethical and economic right of claim to be honourably provided for by the present active breadwinners of the State generally, in return for the services rendered by such of the survivors of those breadwinners who supported, maintained, and educated the present generation of breadwinners during their helpless earlier stage of childhood.

Let us, for closer comprehension of this aspect of the subject, take for illustration the following case of a breadwinners who marries at the age of 23; has 8 children at the age of 55. Each child has been maintained and educated up to the age of 15 years. The age of the breadwinner at the birth of each child is assumed at the age of 24, 26, 28, 30, 33, 35, 37, and 41 respectively.

The chief breadwinner becomes a charge upon his eight children at the age of 65 years until his death at the 76th year of his age. The ages of the supporting breadwinner's children at parent's 65th year of age, and at his death at the 76th year are as follows:—

| | 1st child. | 2nd. | 3rd. | 4th. | 5th. | 6th. | 7th. | 8th. |
|---|---|---|---|---|---|---|---|---|
| Age at Parent's 65th year ... | 41 | 39 | 37 | 35 | 32 | 30 | 28 | 23 |
| Age at Parent's 76th year ... | 52 | 50 | 48 | 46 | 43 | 41 | 39 | 34 |

| | Debt of Children to Parent Breadwinner at the Father's 65th year of age for 15 years' maintenance and education. | Less Share of Children's Support of Parent during his 11 years of infirmity due to old age. | Balance of Debt still Due to Parent. |
|---|---|---|---|
| | £ | £ | £ |
| 1st child ... | 416·15 | 35·95 | 380·20 |
| 2nd ,, ... ... | 388·48 | 33·56 | 354·92 |
| 3rd ,, ... ... | 362·65 | 31·32 | 331·33 |
| 4th ,, ... .. | 338·62 | 29·25 | 309·37 |
| 5th ,, ... ... | 305·34 | 26·37 | 278·97 |
| 6th ,, ... ... | 284·96 | 24·62 | 260·34 |
| 7th ,, ... ... | 266·09 | 22·98 | 243·11 |
| 8th ,, ... ... | 224·04 | 19·36 | 204·68 |
| Total 8 children | 2,586·33 | 223·41 | 2,362·92 |
| Per cent to original debt of child ... | 100· | 8·63 | 91·37 |

These figures are of the greatest significance, from the ethical and economic point of view, in the support they give to the cause of old age pensions. It indicates clearly that there is no economic or ethical claim so firmly based upon justice and equity, for demanding some reasonable share of the existing available consumable wealth of the State. The economic debt claim alone, due by the eight children to the one surviving parent who has become infirm and helpless at the age of 65 years, is calculated actuarily to amount to a capital sum of £2,586, equivalent on the average to a contribution of £323.6 per child. The average after "life expectation" of a person aged 65 years may be estimated on the basis of life assurance experience to be 11years. It follows, therefore, on equitable grounds that the surviving parent might fairly claim, if it were at all practicable (i.e., if the eight children, now all breadwinners, possessed sufficient means), an annuity or pension of £287.3 for the remainder of the parent's life, equivalent to a contribution annually for 11 years of £35.9 per child. But while the justice and equity of the claim of such a parent is thus more than fully established from an ethical point of view, it would altogether depend upon the financial means of the eight members of his family whether such a claim could possibly be satisfied or actualised in practice. The world's experience hitherto is sufficient to show that the full claim — even of surviving aged parents who require aid by means of a pension or allowance — could not be realised in practice for several reasons, the more important of which are the following: —

(1) Some aged persons 65 and over have few children or none. Some or all children of such aged parents: —

(2) Are too poor themselves to fulfil parental obligations.

(3) Are too selfish and unwilling to do so.

(4) Die or disappear before the parent arrives at the old age limit of 65 years.

(5) All persons 65 and over who are infirm and helpless, and who are not supported by living children or friendly relatives, are now indirectly provided for by non-relative breadwinners through the medium of State taxation.

The only way to overcome the obvious difficulties connected with any scheme, whose object is the honourable maintenance and support of all helpless and infirm breadwinners who survive their 65th year, would be for active breadwinners as a whole (the State) to adopt the wise and providential policy of pooling all the risks and benefits as in the skilfully devised actuarial provisions of the various fire, life, and marine insurance, and assurance organisations, as also our important friendly societies now managed with such marvellous success in all civilised countries.

## PRESENT AVERAGE CONTRIBUTIONS BY EACH BREADWINNER PER YEAR TOWARDS MAINTENANCE OF DEPENDENT OR HELPLESS NON-BREADWINNERS.

### FOR HUMANE PROVISION.

| | Estimated Contribution Per Breadwinner. £ | s. | d. |
|---|---|---|---|
| Maintenance and support of all children under 15 years of age, say, £14 each ... ... ... ... | 11 | 12 | 9 |
| Education of children in State schools ... ... ... | 1 | 6 | 10 |
| Maintenance of hospitals and charities ... ... ... | 0 | 14 | 1 |
| Total humane provision ... ... ... ... | 13 | 13 | 8 |

## PROPOSED BENEFITS (OLD AGE PENSIONS) TO AGED AND INFIRM BREADWINNERS.

| | Equivalent Amount Per Breadwinner Per Year. |
|---|---|
| The surviving breadwinners at 65 years and over who, through old age and infirmity, may be unable to support or adequately support themselves, to be entitled to and assured of an income, pension, or equivalent provision, which, together with any private source of income, shall not exceed £52 per annum for the remainder of life, but failing any private source of income, shall not fall short of a sum of £18 per annum. A further condition for securing such pension is that the claimant must have led an honourable life and must have resided in the State as an independent breadwinner or semi-breadwinner for a period of not less than 20 years... ... .. ... ... | 0 11 4 |

The practical experience of New Zealand proves that a provision of this kind would not include more than 1.38 per cent. of the total population; 3.35 per cent. of all breadwinners, and about 35 per cent. of all persons of the age of 65 years and over. The average amount of actual pension for each pensioner would be about £17 per head, and its present capital value for the remaining expectation of life at 65 would, at 3½ per cent., represent a capital value of £153.

Let us now get at the average effect of the debt of the group of children under 15 years for maintenance and support as due to the parents represented by the group of breadwinners between the age of 25 and 65 years. The children represent 35.40 per cent. of the total population, and the breadwinners between the age of 25 and 65 years represent 24.54 per cent. It means that every 100 breadwinners of the group, on the average, maintain 144 helpless children (or, as 1 to 1.44) for 15 years. The annual support for 15 years of such children would cost each breadwinner of the group, with interest at 3½ per cent., a capital amount equivalent to £389, which, if then treated as a debt unpaid improved at compound interest for 25 years longer, i.e., until the breadwinner attains the age of 65 years, would represent the debt of youth to age, as equivalent to a capital sum of £918.

On the other hand, let us see how far it would be possible for the children (when they attain the age of the independent breadwinner at the 21st year) to repay to age its indebtedness to the latter, as measured by an assumed contribution to Old Age Pensions, if restricted to £17 per head of such aged and infirm persons who would probably come under its provisions. This would mean that 46 per cent. of the population for 44 years would contribute jointly their fair share to the support and maintenance of 3.35 per cent. of the population, which is a close estimate of all the aged infirm persons who can come under the qualified conditions which determine the aged infirm 65 years and over entitled to the assumed Old Age Pension of £17 per head per year. The final result would be that to discharge this limited provision for old age pension would only demand an annual contribution of £1 4s. 9d. from each breadwinner for 44 years, and which in that time would accumulate to a sum of £125, thus leaving an unredeemed balance of obligation of £793, or 86.39 per cent. still remaining to the credit claim of old age as against youth; or, more significantly, to the unredeemable credit balance of old age as against the existing breadwinners, or, looking at the latter from an abstract point of view—the State!

On the whole, therefore, it has been reasonably demonstrated that the claims of honourable and helpless old age to a State pension are indubitably established as rightful on both ethical and economic grounds.

## THE PRACTICABILITY OF OLD AGE PENSIONS.

The absence in the existing individualistic State social organisations (with few exceptions) of any provision, save dishonouring pauperism, for the industrious and respectable breadwinners of the past, who from age and poverty have become helpless and infirm, is a lasting reproach, and requires immediate remedial attention if it is to successfully withstand the rapidly growing forces which advocate the adoption of the Fabian and other extreme forms of Socialism.

Nearly all the advanced leaders of drastic socialistic schemes, such as the advocates of the "Eisenach Programme," proudly proclaim that they recognise the ethical and economic right of helpless old age, as well as of helpless children to an honourable share of the currently produced necessaries and comforts of life, not as a humiliating pauper dole, but as a primary rightful claim.

The alleged impracticability of making such provision on the lines of existing individualistic State Socialism may be dismissed in view of the success which has attended the introduction of provision for old age pensions in Germany, Denmark, New South Wales, Victoria, and New Zealand; and notably so in the latter.

The New Zealand experience is extremely encouraging. The Old Age Pensions Act, in that wonderfully progressive State, came into force on the first day of November, 1898, and has now been successfully administered for seven years. The breadth of its experience, and the ability shown in the administration of the Old Age Pension Act form an admirable object-lesson to other countries. An enthusiastic admirer* of the New Zealand scheme of old age pensions makes the following observation thereupon:—"Looking at the Old Age Pensions Act in New Zealand, and the success that has up to the present attended its administration, it is impossible not to see — even though the colony is small compared with our own country — that the idea of a nation pensioning its old citizens is practicable and workable." . . . . "The New Zealanders made their experiment with a simplicity and courage which startled old-fashioned politicians, but which has justified itself by results. The preamble to the Act affirms that 'it is equitable that deserving persons, who, during the prime of life helped to bear the public burdens of the colony by the payment of taxes, by their labour and skill, should receive from the colony a pension in their old age.' " . . . . "New Zealand found itself with its aged men and women who were past work, and who — for whatever reason — were without the means of subsistence." . . . . "Separating the criminal from the honest man, the wife deserter, and the drunkard from the decent citizen, they found it in a national system of pensions." . . . . "A claimant for a pension must have been a citizen of the colony for twenty-five years, must not have suffered during that time for any offence 'dishonouring him in the public estimation,' must not, if a husband, have deserted his wife, if a wife, have deserted her husband, must not have an income of more than £52 pounds a year, or accumulated property of more than £270 and upwards, and must be of good moral character, and within five years of claiming the pension must have led a sober and reputable life."

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*Mr. Frederick Rogers, "Old Age Pensions" "Pro. and Con. Series." (Isbister and Co. Ltd., London, 1903.)

Such safeguards as are here stated entirely remove all the objections based upon the so-called universal schemes of old age pensions, and which formed the chief stumbling block to the adoption of the English Select Committee's scheme (Mr. Chaplin's, 1900), and adversely reported upon afterwards by a Departmental Committee consisting of Sir E. W. Hamilton, K.C.B., E. W. Brabrook, Esq., C.B., S. B. Provis, Esq., C.B., and Noel Humphreys, Esq.

The following tabular results of the working of the old age pension schemes in New South Wales, Victoria, and New Zealand will afford to those interested a better grasp of their scope and character:—

## OLD AGE PENSIONS IN NEW SOUTH WALES, VICTORIA, AND NEW ZEALAND.

(Based upon Latest Official Publications.)

| | N.S. Wales. | Victoria. | New Zealand.‡ | |
|---|---|---|---|---|
| | 1903. | 1904. | 1902. | 1904-5. |
| Total Population ... ... No. | 1,422,803 | 1,207,808 | 820,217 | 875,539 |
| Population, 65 years and over No. | 48,802 | 66,429 | 33,465 | 34,990 |
| Percentage 65 years and over to total Population ... per cent. | 3·43 | 5·50 | 4·08 | 4.08 |
| Number 65 years and over actually in receipt of Pension ... No. | 19,596 | 12,622 | 14,167 | 11,812 |
| Percentage ditto to total Population ... ... ... per cent. | 1·38 | 1·05 | 1·73 | 1·38 |
| Percentage ditto to all ages 65 years and over ... per cent | 40·15 | 19·01 | 42·11 | 33·76 |
| Amount of Pensions actually paid to Persons 65 years and over... £ | 468,353* | 200,436 | 210,411 | 195,475 |
| Ditto per Pensioner ... ... £ | 23 18 0 | 15 17 7 | 14 17 0 | 16 11 0 |
| Ditto per head of Population £ | 0 6 7 | 0 3 4 | 0 5 2 | 0 4 6 |
| Ditto per head of all at ages 65 and over ... ... ... ... £ | 9 11 11 | 3 0 4 | 6 5 9 | 5 11 9 |
| Maximum Pension allowed per year— | | | | |
| To one Person ... ... ... £ | 26 0 0 | 20 16 0 | 18 0 0 | 18 0 0 |
| To each of Married Couple ... £ | 19 10 0 | 20 16 0 | 18 0 0 | 18 0 0 |
| Maximum Income allowed, including Pension— | | | | |
| To one Person ... ... ... £ | 52 0 0 | 26 0 0 | 52 0 0 | 52 0 0 |
| To each of Married Couple ... £ | 39 0 0 | 26 0 0 | 39 0 0 | 39 0 0 |
| Length of Residence in State to qualify for Pension ...No. years | 25 | 20 | 25 | 25 |

*Partly estimated.

‡ Since this paper was read, an amending Act has been passed in New Zealand. The new provisions are:—(1) An increase of pension from £18 to £26. (2) An increase from £52 to £60 of the amount of income required to disqualify. (3) An increase of joint income required to disqualify (with pension added) from £78 to £90. (4) An equal division of property between husband and wife. (5) An increase of the deduction from property in certain cases from £50 to £150.

## THE REAL MEANS OF SUBSISTENCE.

The satisfaction of the wants of man is the mainspring of all his activities. Wants are interminable. Some satisfactions affect his very existence from day to day, while others only concern in greater or lesser degree his comfort or happiness. But whatever eccentricities may be exhibited by isolated individuals at times, it is unmistakable that the intensity of the struggle for the satisfaction of wants in all communities is determined by the nature of the wants; and invariably the greater intensity of the struggle, beginning with the most essential, is in the following order:—

1. The satisfaction of wants essential to life, viz.—food, shelter, and rest.
2. The satisfaction of wants essential to comfort.
3. The satisfaction of luxurious wants.

Man — whether millionaire as regards nominal claim upon capital wealth, or beggar without any nominal claim —may exist without the enjoyment of luxurious satisfactions. He may be deprived of all satisfactions saving the first group, and still maintain a more or less extended life struggle with patient fortitude; but if the satisfaction of the primary wants of the first group — food, shelter, and rest—be ever so little curtailed below a certain minimum, he, whether capitalist or pauper, will speedily perish miserably.

Man lives by actual current or annual productions intended for consumption alone — consumable wealth — and not upon fixed capital or animate or inanimate instruments of production, or their nominal claim values, whether annual or capital; and when we discover that services currently rendered, whether by instrument, skilled mind, or hand, constitute the base of what forms the real purchasing power or claim over "consumable wealth" currently available, we are able to more clearly perceive that the distribution of that form of wealth which comprises the immediately necessary products upon which subsistence depends, is determined — not as fallaciously assumed by the proportion of claim which each man holds of the Statistician's wealth — i.e., the fixed non-personally consumable instruments of production, which the nominal owner no more consumes than the servants who control them, but —strictly by the express measure which current services of various degrees of exchange value have enabled each worker or useful service to constitute a claim upon the current available aggregate products of such services whose values are contained and incorporated in the current production of consumable wealth. The great stumbling block to many who have attempted to deal with the question of old age pensions has been the failure to realise that the essentials for the support, maintenance, and the life of the individual units of the State in any one year, do not consist of, or depend upon the previous accumulations of the compounded interest of sinking funds, money, or nominal investments, or savings. The province of monetary investments, or other forms of claim, lie wholly within the artificial domain of what may be termed "Banking Economics," and although the latter domain is absolutely essential to the existing form of State Socialism in building up, measuring, distributing, or determining the various forms of individual claims upon or titles to the economist's nominal "wealth of exchange"—the distribution of it by any process, neither in itself forms part, nor can it augment or diminish the needful store of real "consumable wealth" (mostly perishable or wasted if not used within the year of production) produced by labour, instruments of production, and Nature's free gifts, of any one year, upon which alone all persons depend for the real essentials of life, health, comfort, and well-being.

Nominal capital, or other claim or title to economists' "wealth of exchange" (i.e., money, promissory notes, mortgages, stocks, title deeds of property, capital invested in instruments of production, and such like), however skilfully and mathematically summed up by accretions of interest forborne, and however great, can never be put in force in excess of the actual volume of "consumable wealth" (real wealth) which has been produced or is available for consumption in any one year, nor can such claims immediately, by any process of finance, create, augment, or diminish any portion of the year's products. All such artificial claims are of necessity limited in application, to the measurement and allocation of title or claim to whatever consumable wealth may be absolutely necessary to the claimant, and available at the moment of presentation of claim.

The well-being of any community in any one year is, therefore, determined, not by the nominal capital or annual values of its instruments of production, but by the volume and character of the created products of the year available to all claimants for consumption.

To realise this most important distinction more closely in a practical way, let us examine the well-being of a country by its "Standard of Living," i.e., its average wealth yearly consumed and enjoyed.

Let us, for illustration, take the experience at the present day of the estimated average "Standard of Living" of the people of the Commonwealth of Australia, and its character as shown in the following summary:—

TABLE SHOWING CHARACTER OF THE FORMS OF WEALTH (CONSUMABLE WEALTH) ACTUALLY PRODUCED AND CONSUMED IN EACH YEAR IN AUSTRALIA, TOGETHER WITH ITS EQUIVALENCE IN THE HOURS OF HUMAN LABOUR ABSORBED ANNUALLY IN ITS PRODUCTION PER HEAD.

| HUMAN CONSUMPTION. | COST. | | | | Equiv'lence in Hours of Labour. | Per cent. to Total |
|---|---|---|---|---|---|---|
| | Per Year. | | | Per Day. | Per Man. | Per cent. |
| | £ | s. | d. | d. | | |
| Food and Clothing ... ... | 19 | 9 | 3 | 12·80 | 1,011 | 42·13 |
| Rent, Fuel, and Light ... | 9 | 5 | 2 | 6·09 | 481 | 20·05 |
| Spirits and Tobacco .. ... | 4 | 1 | 8 | 2·68 | 212 | 8·84 |
| Religion, Education, Charities, etc. ... ... ... | 3 | 8 | 1 | 2·24 | 178 | 7·37 |
| Art and Amusements ... | 1 | 2 | 8 | 0·75 | 58 | 2·45 |
| Medicines and Medical Attendance ... ... ... | 1 | 1 | 8 | ·70 | 56 | 2·35 |
| Other Services... ... ... | 0 | 16 | 0 | ·53 | 42 | 1·74 |
| Total Human Consumption. | 39 | 4 | 6 | 25·79 | 2,038 | 84·93 |
| Man's auxiliary instruments actually engaged in production ... ... ... | 6 | 19 | 3 | 4·58 | 362 | 15·07 |
| | £46 | 3 | 9 | 30·37 | 2,400 | 100·00 |

The total amount of real wealth annually consumed in the Commonwealth of Australia by the whole population is estimated at present to be about £185,340,000, or £108 9s. 8d. per breadwinner, or £46 3s. 9d. per head of the total population, including non-effective dependents.

The capital value of property (a) is land, houses, live stock, furniture, machinery, shipping, railway plant, gold and bullion, personal effects, and all other instruments of production, transport and manufacture, is estimated at present to amount to £980,000,000.

It forms no part, however, of the £185,340,000 of the real wealth of products and services annually consumed and enjoyed by the people any more than the estimated capital value of the effective producing energies of man's labour and skill (b), which may be reckoned to amount to a sum of at least £2,937,700,000.

The combined effective capital value of (a) property, and (b) man's effective labour and skill, services engaged in the production of real or consumable wealth, is estimated at £3,917,700,000. All the capital value of claims which the combined agents of production can put in force in any one year therefore cannot exceed the value of consumable wealth produced within the same period, viz., £185,340,000, representing about 4.73 per cent. of the total capital claim. If we now set down the fair proportion which the two classes of producing agencies (a) and (b) can lay claim to the annual consumable wealth produced and available, it would stand as follows:—

### Approximate Proportion of Consumable Wealth of Australia Distributed on the Basis of the Amount of Relative Claim of the Actual Effective Forces of the Producing Agencies engaged.

| | Mode of Claim. | Capital Value of Producing Agencies and Instruments. | Annual Share of Products, Consumable Wealth. | Per Centage. | |
|---|---|---|---|---|---|
| | | | | To Capital. | To Total. |
| | | £ | £ | p. cent. | p. cent. |
| (*a*) Capital invested in Property and Instruments of Production .. | Rental, Interest, Tribute, Taxes, etc. | 980,000,000 | 46,360,000 | 4·73 | 25·00 |
| (*b*) Capital Value of Effective Labo'r and Skill of Man engaged in the work of production .. .. | Commission, Wages, Salary, etc. | 2,937,700,000 | 138,980,000 | 4·73 | 75·00 |
| Total .. .. | | £3,917,700,000 | £185,340,000 | 4·73 | 100· |

From this analysis, which is sufficiently comprehensive, it would appear that ordinary labourers are simply poor capitalists, and that employers and wealthy people are rich capitalists: that both forms of capital are necessary to the production of the current necessaries of life; and that both — whether as interest, rental, or tribute, or as commission, wages, or salary — derive their share of these necessaries of life by their combined action.

In this view of the case it is no more true or false that commission, wages, and salary are derived from the abstract idea, capital, than that rental, interest, tribute, and taxes are derived from capital.

The object of all this reasoning is to show that if the citizens of any State impose any new function — such as provision for old age pensions — upon the State Administration which may be deemed necessary to the life and well-being of its members, it creates for the State administrators a real right of claim upon whatever consumable wealth is available, commensurate with the cost of the function so imposed. The mode of claim by the State, which would correspond with that of capitalists' interest, rental, wages, or salary, would be that of taxation.

Two chief arguments of all objections to old age pensions are:—(1) That it adds additional cost to the country, and (2) that it would destroy the existing habit of thrift.

## 1. THE DIFFICULTIES ARISING OUT OF AN ALLEGED ADDITION TO THE COST OF THE COUNTRY.

The introduction of old age pensions for the reasons given in the previous pages would entail no fresh or additional cost to the country, or to breadwinners or taxpayers in the aggregate. It would only distribute the existing provision for support and maintenance in a less humiliating form, in a less costly manner, and in a more equitable and effective way. It would relieve to some extent the unequal direct burden now imposed upon the willing, kind, and conscientious; and impose, indirectly by taxation, a little more burden upon the selfish and unwilling who at present to a large extent evade directly their rightful share of burden.

By the present haphazard provision it often happens that the forward, hypocritical, and undeserving poor get more than their fair share, while the unobtrusive, shrinking, but deserving poor, get little or nothing.

## 2. THE ALLEGEMENT WHICH ASSUMES THAT OLD AGE PENSIONS WOULD HAVE THE EFFECT OF TENDING TO DESTROY THE EXISTING HABIT OF THRIFT.

Thrift is a word that may mean many things. In a reply to this objection, Mr. Frederick Rogers observes:—"To many (thrift) it appears simply to mean the saving-up of money, but that virtue (?) is not likely to flourish among people who have no money to save. Mr. Charles Booth showed in his evidence before the Commission on the Aged Poor that two-fifths of the adult population of England and Wales consist of agricultural labourers, unskilled town workers, and women wage-earners, and that these classes account for 80 per cent. of the paupers of our own country, and that two out of every three who live to old age have come to the Poor Law for assistance. Sir Robert Giffen told the Labour Commission that there are one million and three-quarters of adult men in the United Kingdom earning a pound a week or less. There are no figures to show how many millions of women there are living on half that sum." Mr. Rogers goes on to add:— "It is a cruel mockery to talk about thrift to classes like these." . . . . "The problem of how to treat the deserving poor was the subject of a special committee's report to the Stockton Guardians." . . . . "Mr. Andrews, in moving the adoption of the report, stated that of the 783 persons in the workhouse over 64 years of age, 370, or 47.88 per cent., were deserving poor who had been well-behaved and self-supporting. The cause of 370 persons entering the workhouse was the smallness of the wages they had received, not drink."

"Thrift is in the last result of making the best" . . . . "that can be got out of existing circumstances." . . . . 'It has often happened that the duties lying nearest to hand have rendered it impossible for the man or woman to make provision for their old age, as they have been the keeping of aged parents for a long period of life. But no theory of thrift could ever excuse a human being for neglecting his or her duties to their family for the sake of providing . . . . for an old age that he is not sure he will ever live to." . . . . "It would be a form of human selfishness that would win for its practiser the wholesome contempt of their fellows of society." Mr. Rogers concludes with the statement . . . . that "common-sense indicates that a young man is not likely to refuse to make provision for the mishaps and misfortunes of his younger years, because he is likely to get a pension from the State when he is old."

## THE EFFECT OF THE ADOPTION OF OLD AGE PENSIONS ON THE LINES OF NEW ZEALAND IN THE COMMONWEALTH OF AUSTRALIA.

There are at present in the Commonwealth of Australia a population (exclusive of aborigines) of 3,984,376 persons, of which it is estimated that 159,375, or 4 per cent., are of the age of 65 and over. By the seven years' experience of New Zealand it may be safely reckoned, under the conditions prescribed for old age pensions, that about 55,781 persons, or about 35 per cent. of the old age group, 65 and over, would become pensioners.

This, at the average pension of £17 per pensioner, would represent a cost to tho State of £948,177 per annum, and a tax of 4s. 9d. per head.

The burden and effect of such a provision to each State on the basis of population would be somewhat as follows:—

## PROPORTION OF TAX BURDEN FOR EACH STATE ON ACCOUNT OF OLD AGE PENSIONS.

| | Per centage of Total Population. | Old Age Cost. | Less Existing State Provision (if any) 65 & over. | Burden. | |
|---|---|---|---|---|---|
| | | | | Increase. | Decrease. |
| | | £ | £ | £ | £ |
| N. S. Wales ... | 36·58 | 346,843 | 468,353 | — | 121,510 |
| Victoria... ... | 30·38 | 288,056 | 200,436 | 87,620 | — |
| Queensland ... | 13·09 | 124,116 | *nil.* | 124,116 | — |
| S. Australia .. | 9·35 | 88,655 | *nil.* | 88,655 | — |
| W. Australia ... | 6·08 | 57,649 | *nil.* | 57,649 | — |
| Tasmania ... | 4·52 | 42,858 | *nil.* | 42,858 | — |
| Commonwealth | 100 | 948,177 | 668,789 | 400,898 | 121,510 |
| | | | | 279,388 | |

Only to one of the two States that now make provision for old age pensions for ages 65 and over (N.S. Wales) would the adoption of the New Zealand scheme be of advantage to the local State Treasury or local State. To enable the Commonwealth to bear the burden of old age pensions for Australia as a whole, it would have to raise an additional revenue by taxation of at least £948,177.

## CONCLUSION.

However fair and desirable it may, therefore, be that the Commonwealth of Australia should adopt the scheme of old age pensions, and notwithstanding that the citizens themselves as a whole would have their State and direct personal burden lessened in proportion, as to the extra indirect taxation required from them by the Commonwealth, the real practical difficulties which would arise, and would have to be overcome, would be the fiscal one. It would mean a complete revisal of Customs and Excise tariff, and this would involve much personal differences of opinion among our Australian Statesmen. It would be both unjust, as well as impossible, to try to raise, by direct taxation, so large a sum of revenue. The burden should fall broadly and as lightly as possible on all existing persons who may in their own old age have to claim a right to a pension. In no other way could the broad mass of citizen breadwinners contribute to enable them to establish such a claim than by the easy, flexible, and indirect method of extra duties on consumable goods through the machinery of Customs and Excise.

Should the latter policy be adopted, I have no fear but that the noble object of honourable provision for well-deserving old age breadwinners who have become pecuniarily disabled in life's battle, will soon become an accomplished fact.

# "INSECTS AND DISEASE."

By J. S. C. Elkington, M.D., D.P.H.,

Chief Health Officer of Tasmania,

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(Read 9th May, 1904.)

Elkington said:—The subject upon
I have been asked to address you
'ening is one which has, within the
x years, produced a profound alter-
in several branches of science.
n Tasmania we are fortunately free
hose scourges of humanity which
yet known to depend wholly for their
upon the agency of insect life, but
rith us the problem is not wholly
outside interest, as I will endeavor
w you in relation to typhoid fever.
case, however, the method of con-
e is purely a mechanical one, due
icles of infected matter clinging to
gs and bodies of flies, and subse-
y deposited upon food material,
e it is taken into the alimentary
of the victim. It is advisable,
re, to clearly distinguish between
o methods in which insects play a
spreading disease amongst human
whether—

ls carrying agents pure and simple,
ecting agent undergoing no change
t being dependent on the insect in
y.

ls hosts, intermediate or definitive,
fective organism being dependent
ne insect and undergoing an extra-
al phase of development in its

first group is of distinct import-
om the sanitarian's point of view,
it teaches us to guard against
danger in times of prevalence
of certain infectious diseases, but the second one far outweighs it. Into this second group fall some of the chief scourges of mankind, in tropical regions at any rate, and of these the greatest is malaria. Next to tuberculosis, malaria is probably the greatest cause of death and of ill-health with which mankind has to contend. Some of you have, no doubt, visited or lived in places where malaria, or even Yellow fever, have claimed their yearly toll of lives and health, have seen the long white-washed wards and wide verandahs of an Indian Cantonment Hospital filled with pasty-faced fever-stricken soldiers, and have heard day after day the drone of the regimental bands along the dusty white roads to the cemetery. To that supreme critic of all our actions, the "man in the street," the proof of the conveyance of malaria by the agency of certain species of mosquitoes was merely an interesting piece of knowledge, but to those who know what the disease in question really means, it was a fact of startling importance, presaging the approach of effective means of checking an enemy which in the year 1897 alone laid 75,821 British soldiers by the heels in hospital out of a total strength of 178,000 odd in all India. I need hardly remind you how nobly the promise of that great discovery has been fulfilled, how "the white man's grave" of former years has become the white man's sanatorium, and how it is now possible for the march of

Anglo-Saxon civilisation to progress in places where even six years back a newcomer could count his reasonable expectation of life on the fingers of one hand. Tropical medicine has assumed such great proportions that it practically forms the pivot upon which turns the whole question of European colonisation in the tropics, and, practically speaking, tropical medicine is very largely based upon the spread of disease by insects. There, freedom from malaria practically means freedom from ill-health. The London and Liverpool schools have received noble recognition from Mr Chamberlain, and from hard-headed business men who can see into the future. Many a Peter the Hermit is leading a crusade against disease with knowledge, and often with funds supplied in this way, enabling the British race to get on a step further with colonisation. America has taken up the work with especially striking results in relation to Yellow fever, and a handful of workers succeeded in clearing Havana of this fell disease in ninety days—after it had had an uninterrupted reign for 140 years. The discoveries which have been made are, I think, but a foretaste of those which are to come, but their histories, with the patient record of constant toil over minute details, of the sacrifice of leisure and recreation, and even in some cases of the lives of the workers for the furtherment of knowledge, form, to my mind, one of the noblest romances ever written. The work of Manson, Ross, McCallum, Reid, and others have revolutionised the methods of research into human disease, and there is little doubt that we are on the verge of further great discoveries in which the lower forms of life will be found to play an essential part in disease affecting mankind. But this may appear to be something of a digression from the practical treatment of my subject. I trust, however, that I have shown you to some small extent the importance of the results obtained, and the possibilities which they open up. I will now endeavor, with the aid of a few lantern slides, to indicate in some measure the manner in which these discoveries have been made, the difficulties against which the workers had to contend, and the method in which they are practically applied.

The classical example is, of course, supplied by malaria, or paludism, as it is often termed. As I need hardly point out, both these terms indicate the association with the presence of marshes, swamps, and other wet-soiled localities, which has been for centuries noted in connection with the disease, malaria meaning merely "bad air," and paludism the condition induced by marshes. Now, about the middle of last century, certain observers noted the presence of certain brown and black granules in great numbers in the blood and organs of malarial patients, and in 1880, Dr. Laveran, a French military surgeon in Algeria, made the discovery that the black granules, which are known as melanin, were produced by the action of immense numbers of tiny parasites living in the red blood corpuscles. This was a very notable discovery, as it naturally caused enquiry into the manner in which the parasites got into the blood corpuscles, and once there how they produced the fever. It was found that they could not be grown on artificial media, even from blood which swarmed with them, and other discoveries soon made it clear that they represented a distinct form of animal life, and not a vegetable one, like the bacteria for instance. Some five years later another discovery was made, namely, that these parasites breed in the blood, and that the attacks of fever coincide with the breaking up of the cluster of spores so formed. It was also found that three varieties at least of the organisms infect men, and that yet others were to be obtained from the blood of birds, bats, cattle, monkeys, and other animals.

(A picture was then shown of one form of malarial organism as it appears under the microscope in the various stages of development, which are traceable in the blood so long as it retains its vitality after removal.)

Under the microscope, the strange octopus-like creature, which represents the last stage of development in blood specimens, would attract your attention even more than in the lantern pictures, since its arms are in vigorous motion from the time they shoot out from the surface. If kept moist and warm another strange phenomenon occurs. One or more of these arms will be seen to sepa-

itself from the body and to shoot
ously away. So vigorously, and with
apparent intention does it do so, that
ten sets the surrounding corpuscles
ng like a row of corks in a tideway.
years a discussion raged over this
omenon. Why did the organism
out these arms only after leaving
ody? The octopus-like creature, or
gamete, was never seen in blood
diately after its removal, but de-
ed from certain of the parasites, but
ll, in a short time when kept warm
noist. If not kept warm and moist
not develop. Moreover, why was it
nly some of the amœboid organisms
out arms and not all? And why
e or more of the arms when thrown
ast loose from the rest and dart
?

on these and similar facts Dr.
on, then of Hong Kong, formulated
94 that fine piece of inductive
ing which will always be associated
his name. Earlier observers had
time to time made suggestions of a
r nature, but it was reserved for
on to formulate from the known
a true scientific hypothesis. Being
arasite, he argued, the malarial
ism must, like most other parasites,
r part of its existence outside the
n body in another host. The
s-like male gamete does not come
existence until after leaving the
and while in the body the parasite
apable of liberating itself by its own
. No traces of the parasite could
und in any of the discharges
he patient. It was there-
probable that it was re-
l from the body by some blood
creature. Manson had previously
med some brilliant researches into
onveyance of certain other blood
tes by mosquitoes, and he was led
conclusion that some distinct kind
squito was the probable agent, and
e male gamete formed the first stage
extra corporeal development of the
te in its new host. I need scarcely
d you that in all its main points
n's hypothesis has been proved
t.

n Captain (now Major) Ross, of
ndian Medical Service, took up the
of investigating the development in
osquito. It must be remembered that he began with practically no knowledge of the classification, structure, or habits of mosquitoes, since at that date (1895) comparatively little was known even to dipterologists, and that most of his work was done in an up-country Indian station far from the equipment and facilities of a modern laboratory. For two and a-half years he worked on, dissecting and examining, cell by cell, hundreds of mosquitoes without result, and attempting feeding experiments in vain. It is natural that after such an extended series of negative results he was beginning to suspect a flaw in Manson's theory. Then came light. A peculiar species of mosquito, which he had once before noticed in a very malarious locality as possessing dappled wings and laying boat-shaped eggs, was fed upon the blood of a malarial patient, and on dissecting it he found, for the first time, in its tissues granules of that coal black substance which I mentioned as being called melanin, and as characteristic of malarial fever, and in its stomach walls certain oval cells. These discoveries practically solved the problem. The dappled winged mosquito with boat shaped eggs belonged to the genus Anopheles, and the oval cells in the stomach wall were the developing parasites of remittent malarial fever.

The rest was comparatively easy once these facts were known.

The plague scare amongst the natives made it necessary for Ross to pursue his researches into the development of the organism in the mosquito by means of a closely similar organism conveyed by a Culex to birds, since blood feeding experiments from human beings became practically impossible, but he had solved the two great problems in the way of the triumphant proof of Manson's hypothesis, and that hypothesis was proved to be soundly founded. He had, moreover, distinguished the true malefactor—the Anopheles mosquito—from the innocent Culex, and his previous difficulties were to some extent explained by the silent retiring and unobtrusive habits of the former genus. The differences between Culex and Anopheles are clear enough nowadays, but it is proverbially easy to be wise after the event. We must always remember Ross in his up-country bungalow working on without recognising this shy and unobtrusive genus from the myriads of Culices

The differences are well exemplified in the lantern slides, which I will now show you, and they extend through the insects' lives from beginning to end. In the first place they may be readily enough distinguished by the attitude assumed in resting. Anopheles seems always to be endeavoring to stand on its head, while Culex rests parallel with the surface in a hunched up position. This, of course, is a rough test, but after a little while one becomes very expert in distinguishing the two in a locality where Anopheles are present. I may state that I do not know that any species of Anopheles existing in Tasmania, although one species has been recently described as existing in Victoria. I have not come across a member of the genus in a large number of mosquitoes lately examined in Tasmania. All species of Anopheles are not capable of conveying malaria, a fact which explains the presence of this genus in non-malarial localities where cases are from time to time introduced. The female, by the way, is usually the blood-sucker amongst mosquitoes, a meal of blood being stated to be essential for the fertilisation of the eggs. The male, except in the stegomyia and a few others, is an innocent creature, preferring a vegetable diet of fruit juices, if indeed he does feed at all, and not, like his partner, varying it with animal food extracted in a voracious and annoying manner.

Both male and female are here shown, but, taking the latter first, you will note the length of the palpi—as long or longer than the proboscis. This is in itself, in the female, a mark of the genus. The wings are spotted in both specimens—another fair but not infallible guide-mark to the Anopheles. Turning to the male, you will note that the palpi are also long, but they are always long in the male, whether of Anopheles or Culex. These, however, are clubbed at the ends, and in this particular species are plumose at the ends. The distinguishing marks of the male in this case, as in others, are the large plumose antennæ—regular whiskers, as befits the sex. The adult insects can thus be distinguished, but for complete identification this is not enough. Various markings of the legs and palpi, and the arrangement of the wing and body scales, are used to identify species. The shape of the eggs is different in the two genera, those of the Anopheles possessing a distinct boat shape, while Culex eggs are blunter for the most part. They are laid in masses of from 200 to 400. These eggs develop in the course of from 12 hours to several days into larvæ, which are known to every boy as the "wigglers," found in every tank and pool in fairly warm weather. Here we note another difference in the genera, the Anopheles lying parallel with the surface owing to the absence of the long breathing tube, which enables Culex to hang down from the surface—the direct opposite of the position assumed by the adult insects, as you will recollect. The arrangement of the hairs upon the different segments enables species to be determined. In a week for Culices or more for Anopheles—the time varies considerably in these processes for different species and under different conditions—the active wiggling larva after develops into a pupa, which again differs in the two genera, and after a varying period of from two to 10 or more days the pupa case splits down the back, the adult insect emerges, and after balancing itself on the empty case for a while in order to dry its wings, flies away to propagate its kind in turn.

To sum up the points which I have endeavored to briefly indicate we have the following facts to consider wherever malaria is to be dealt with. There is firstly a blood parasite, which is the cause of the disease, and next come particular species of a particular genus of mosquito, whose tissues afford the only place wherein this parasite can complete its life cycle. Malaria can be conveyed from man to man by injecting blood in which the organism is, but this need not be considered in practice. Therefore, in tackling the question of stamping out malaria we naturally attack the mosquito. The adult insect may be guarded against by mosquito curtains and other measures to prevent its biting—a particularly useful one by the way consists in wearing two pairs of socks after dark, a thick pair underneath and a thin pair on top, since more people are perhaps infected at the dining table than in almost any other way, the Anopheles loving the dark lurking-places under that cheerful board. It may also be killed by

gation with sulphur or pyrethrum
er. This, however, is an incomplete
and since the Anopheles breeds
reference in small puddles and shal-
tretches of weedy swamp or slowly
ng water free from small fish, its de-
tion is rather an engineering than a
cal question. Much may be done by
ng kerosene and paraffin on the
ce in the proportion of about
blespoonful to every square yard
rface, so as to form a thin film, which
the air tubes of the larvæ and
, and also kills the adult female
depositing eggs. This remedy will
und efficient by those of you who
worried by the local Culices, which
e a bloodthirsty disposition in New-
, at any rate. Culices are especially
of small collections of water in pots
anks—the saucer of a flowerpot on a
ow sill may provide sufficient mos-
es to make the inmates' life a misery,
an ordinary 400 gallon tank will stock
ghborhood.

e moral of which, as Captain Cuttle
ecorded to have remarked, lies
e application thereof. I need not
more than that the notoriously
rious localities of Sierra Leone
Freetown, formerly known as the
ite man's grave" in West Africa,
comparatively speaking, been turned
health resorts within two years of
ised effort against mosquitoes, and
at Ismailia, in Egypt, a previously
iously malarial town, the average
er of cases has been reduced from
to 200 per annum by one season's
. Practically, there were no fresh
of malaria once the work was got
, and it is now possible to sleep there
ety without a mosquito net, probably
e first time in the history of the town.
bly everyone here to-night has been
e time or another subjected, un-
, to the gastronomic attentions of a
e mosquito, and the method in which
erforms the operation after a pre-
ary song may be a more or less in-
ing memory on the next occasion you
it culicide. (The lecturer here de-
d with a lantern diagram the
er in which the mosquito feeds).

far we have considered the cor-
l life of the malarial organism,
is, the part of its life-cycle which
ssed in the blood of man, with the single exception of that octopus-like male gamete which, as I pointed out, only developes after leaving the human body. Turning now to the second, or extra-corporeal stage of its life history—i.e., that stage which, as we now know, is passed in the mosquito—we find that there are really two forms of cell developed amongst the organisms, one the octopus-like male gamete, the other a spherical cell. Now, it is only when the Anopheles takes in blood containing parasites at, or about this particular stage of development, that it becomes infected with malaria, and capable of conveying it to fresh human beings, a fact which accentuates the importance of protecting malarial patients by means of mosquito nets wherever possible. Having taken in the blood, however, by means of the complicated sucking apparatus, which I have described, the gametes develop into the sexual form, and the true function of the male's loose arm becomes evident since it joins with a spherical cell formed by another gamete, and impregnates it. It was the female gamete which it was in search of when it cast loose. Then the fertilised cell or zygote attaches itself to the stomach wall of the mosquito, bores its way through, grows greatly in size, and proceeds to divide into a great number of tiny cells. It becomes a cyst, which finally bursts and sets free the tiny structures within, which have meanwhile developed, and these, set free in the body cavity, settle in great part in the veneno-salivary gland at the base of the proboscis, as tiny thread-like bodies, termed zygotoblasts or sporozoits. The gland in which they lie is that which secretes the irritating substance of which we all know the effects in connection with a mosquito bite, and in the case of an infected Anopheles, they are injected with this secretion along the proboscis. The process for their development in the mosquito takes about 12 days from the date of the meal of infected blood, before the thread-like bodies appear in the gland. After injection, along with the secretion, the sporozoits infect the blood corpuscles, grow rapidly, and break up into spores which in time infect fresh corpuscles, until a huge swarm of parasites, with a life cycle of either 48 or 72 hours is produced in the blood. The breaking-up of each swarm sets free

the fever-producing substances which produce the symptoms of malaria. I have given but a rough outline of the process, but it will serve to show the main points of this complicated life-history.

It will be seen, however, that the process of infection by Anopheles is *not* a simple mechanical transference of blood from infected to healthy people, that human cases can only infect the Anopheles at a particular stage in the history of the parasite in their blood, and, particularly, that an Anopheles which does not bear in its poison gland the thread-like spores of malaria representing the last stage of the extra corporeal cycle of the organism passed within its body is as harmless as an empty gun.

It will be readily understood that the work of Ross and his colleagues in other parts of the world gave a huge impetus to the study of insect-borne diseases, and it has borne noble fruit. The connection of Yellow fever with Havana is almost proverbial,and the average deaths from that disease alone were over 800 in each year. It has been estimated that some 36,000 persons died of it from 1853 to 1900, and in addition the island of Cuba and adjoining parts of Brazil acted as an endemic focus, whence, at various times, the disease spread to many parts of the world, including Spain, Africa, and even England. In 1897, there were 6000 deaths from it in Cuba. In Rio from 1868-1897, 41,726 deaths. The Southern States of America have also experienced dreadful visitations from it. "Yellow Jack" was a dreaded name throughout South America, the West Indies, and the Southern United States. With the opening of the Panama Canal and the consequent shortening of the voyage from these localities to Australia and the Far East, it is very probable that Yellow fever will some day be introduced to this side of the world. Three or four years ago, Australian sanitarians regarded this possibility with awe and foreboding; to-day they look upon it certainly as a serious problem, but as one which would give comparatively little trouble compared to the introduction of a few cases of small-pox. I will endeavor to explain how this remarkable change in views has come about.

In 1900, after the occupation of Cuba by the American forces, a commission of four medical men was appointed to investigate the alarming prevalence of Yellow fever there, and to devise, if possible, means for combating it. A great deal of work had been done by various observers in seeking for the cause of it; but nothing was accurately known, and the early work of the commission, devoted to the examination of the blood and tissues of patients, only served to disprove previous theories, and not to discover anything new. Absolutely nothing was apparent in the blood or elsewhere as a result of the most careful bacteriological research. The next step was to enquire into its propagation. Now, one attack of Yellow fever safeguards the patient against a second one, producing a condition of immunity, as it is called. It had been noted that patients could be safely nursed by non-immune nurses, and that patients discharged after an attack did not cause fresh outbreaks of disease in those non-immune persons they came in contact with. It was obviously, therefore, not contagious, nor did the infection persist in a virulent form in the discharges. The next matter was to settle the disputed question of the infectivity of clothing and bedding which had been in contact with patients. To this end, a small hut was erected, very deficient in ventilation, and specially constructed so as to maintain a hot moist atmosphere within it. The windows and doors—please note this—were carefully screened with fine wire gauze, of small enough gauge to prevent the entry of mosquitoes. Into this house were piled sheets, blankets, mattresses, pillows, and clothing of all description from the Yellow fever hospitals, and amongt them, in the beds and covered with the bedding of patients, who had just died of Yellow fever, even wearing the clothing taken from the bodies, and stained with the blood and "black vomit" discharge, seven young non-immune Americans, including members of the commission, slept two or three at a time for a total period of sixty-three nights in all. Not a single one of these non-immune men developed the disease. This effectually proved that clothing and bedding alone were incapable of conveying the disease, however grossly they were contaminated.

The next step was to enquire into the question of insect transmission. A common domestic mosquito of Cuba is the Stegomyia fasciata, a strikingly marked insect of voracious habits, and suspicion had already attached itself to it. Both sexes of it suck blood, and it is probably the most widely distributed of all mosquitoes, being found practically all through the tropical world, and also in many sub-tropical localities. Twelve plucky young Americans, two of whom had taken part in the experiments with clothing previously described, volunteered as subjects. All these were living under exactly the same conditions as scores of other non-immune residents of the camp, and the two I have mentioned had been free for 80 days from their self-imposed imprisonment in the infected clothes hut. All were deliberately subjected to the bites of specimens of this mosquito, which had been previously allowed to bite early cases of Yellow fever. After periods of from three and a-half to six days from being bitten, all except two developed true attacks of Yellow fever.

One experiment in the batch was of especial interest. A newly-erected building was divided into two parts by fine-wire screens. In one part were let loose 15 infected mosquitoes, and in the other half, separated only by a wire screen, two non-immune men lived and slept. The volunteer subject entered the part in which were the mosquitoes on three occasions of about twenty minutes each, and was freely bitten on each occasion. On the fourth day after his visit he developed a severe attack of Yellow fever, while the two men in the part on the other side of the gauze screen continued for 18 nights to sleep in and breathe the common atmosphere of the room without any ill effect. This was pretty fair evidence even for the scientific mind that the mosquitoes were the conveyors of the disease, and subsequent experiments proved this to be so beyond all doubt.

The organism which is the actual cause of Yellow fever has not been discovered, probably because it is so minute as to escape the highest powers of the microscope. This is the more likely since, as in the case of malaria, the injection of blood from an acute case will produce the disease in a non-immune subject, but, unlike malaria, the blood remains similarly infective after it has been passed through the finest Berkfeld filter, thus proving the extreme minuteness of the organism, since such a filter will stop the smallest of known bacteria. That it is not a bacteria, but an organism more of the type of the malarial organism is very probable from the fact that the infection cannot be obtained by the mosquito from the blood, except in the first three days of illness, and the mosquito does not become capable of infecting fresh persons until 12 days or more after it has fed upon a case at this particular stage. The fact that an outbreak of Yellow fever took a fortnight or so to light up after the introduction of a case into a locality had long been noticed, and this explained the reason thereof.

Having obtained these facts, the battle against Yellow fever assumed a new aspect. Huge sums had been spent during previous years in indiscriminate disinfecting of articles which had been in contact with Yellow fever patients—quite harmless as we now know—and in other expensive measures, absolutely without avail. The campaign was now begun by a wholesale destruction of mosquitoes and their breeding places in swamps and puddles, and by the careful screening of Yellow fever patients for the three first dangerous days, from mosquito bite in order to prevent the loading up of fresh winged carriers of disease. Quarantine of cases was given up—it had been enforced for many years without avail,—and the only quarantine order was that of the mosquito net. The result was amazing. In ninety days from the commencement of operations Havana was freed from Yellow fever for the first time in 140 years. Repeated introductions from without, where the measures were not in force and where Yellow fever was raging unchecked, as it had done for decades past at that season, were promptly stamped out, and the fact was realised that although every effort known to sanitary science had been put forth without avail up to March, 1901, the change effected in the measures by the recognition of the mosquito as the carrying agent had enabled the authorities to obtain in 13 weeks a result which had defied the efforts of more than ten times as many years. Epidemics of Yellow fever, thanks to those able and heroic American doctors, are a thing of the past in civilised countries, and the name of Dr. Lazear, who contracted the disease and died of it during the enquiry, another of the numerous martyrs whom science has claimed, will always occupy an honored place in the scroll of hygienic fame.

I will not do more than give the outlines of certain other work which has been carried out in this direction. The recent investigations which have been made into Sleeping sickness — that strange disease which overwhelms its victims with an increasing languor and somnolence until they perish of an apparent failure of all the faculties—has received a good deal of notice in the press. The researches of Dr. Castellani, Dr. Bruce, and others, go to show that the conveying agent in this case is the Tsetse fly, previously well known for the fatal effects of its bite on horses and cattle, but only lately known to be connected with disease in human beings. The mortality from Sleeping sickness in certain parts of Africa has been alarming, and whole districts have been decimated by its ravages. The causative agent appears to be a form of organism known as a trypanosome, or, as it should be more corretly termed, a herpetomonas, which lives in the blood and fluids of the victim. Further work yet requires to be done, but little doubt remains that the curious and fatal disease which almost invariably kills its victim, and which has been known as a scourge of Western Africa for over 100 years, has been brought within the grasp of science, and will be dealt with as effectually as malaria and Yellow fever are being dealt with. Whether the organism undergoes a part of its life history within the Tsetse fly's body is not yet definitely settled by actual observation, but it seems probable that it does so.

The presence of plague in Australia renders its causation and spread a matter of perhaps more acute interest than the exotic diseases with which I have been dealing. The causative agent is, of course, a well-known bacillus, but the means whereby it is habitually conveyed to human beings to infect them have been widely discussed amongst scientific men, and there is a growing tendency on the part of those who have to deal with this disease to regard more and more suspiciously a certain insect which already possesses an evil reputation in domestic sanitation; I allude to the flea. A good deal of work has been done on these insects of late years, and it may surprise you to learn that more than 180 distinct species of flea have been classified, and that new ones are coming into knowledge month after month. Remarkable differences are found in their structure and habits, but in the particular connection with which we have to consider them to-night, one genus attains prominence—the true pulices of which the type is the human flea.

Now, in considering the histories of plague outbreaks in different parts of the world, one is at once struck by a curious fact, namely, that while preceding or simultaneous outbreaks of the disease amongst rats and other small rodents, have formed a marked feature of plague epidemics in the East, nothing of the kind has attracted the attention of the chroniclers of the European outbreaks of the middle ages, and of the great plague of London in 1665. The phenomenon is striking enough to attract the attention of any ordinary observer where it occurs, and a significant allusion to it is to be found in the First Book of Samuel. Other and even more definite allusions occur scattered through Eastern literature from a very early date, so that it appears to have attracted attention, and could scarcely have escaped the acute chroniclers who have left us such a vivid picture of medieval and seventeenth century plague. It is needless to remind you that the same phenemenon occurs in Australia and in South Africa at the present day. The domestic rats of the East, of Australia, and South Africa are very similar to those of Europe, and all readily contract plague when infected experimentally. But on examination of their parasites a curious fact was noticed in that the common rat fleas of Australia, of India, and of South Africa are widely different insects from the common rat flea of Europe, both in structure and habits. They are very closely allied to the human flea, so closely, in fact, that their relative identification is a matter of extreme difficulty, without previous acquaintance with the genus, and the Indian and Australian

iles, will, on occasion, act as para-
to man, and will bite vigorously.
ommon European rat flea, or cera-
llus fasciatus, on the otherhand, differs
portant structural respects, and can,
with great difficulty, be induced to feed
nan. Does it not appear to be
thing more than a coincidence
where we find a ratflea closely allied
e human flea, there we have plague
gst rats as well as man, whereas in
s where the ratflea varies widely
the human flea the occurrence of
mic rat-plague is, at any rate, not an
rtant phenomenon.

e theory was for long held that the
e baccilus lives and multiplies in
earth, but out of innumerable at-
ts at its recovery from the earth-
s of plague-infected Eastern hovels,
a single success has resulted under
ral conditions. As in the case of
w fever, it has been stated to have
spread by infected clothing. It pro-
is so spread, but in some other way
the mere bacillary infection of such
ing, for the plague bacillus has never
recovered from infected clothing, un-
in cases of gross experimental con-
nation. Plague is particularly a
se of locality, and especially tends to
t those who sleep in such a locality,
ing those who move actively about
g their visits and sleep or rest else-
e. It chooses dark, squalid, vermin-
ted vicinities, and avoids to a great
nt airy, well-lit places. The experience
lague hospitals is a curious one, for
st, in ancient days, even a short visit
pest-house was attended with great
er, it is rare for an attendant in a
ern plague-hospital to be attacked.
the disease itself has not varied from
ent times we know from contemporary
rds, but whilst the modern hospital
pecially built with a view to cleanli-
, light and airiness, the ancient hos-
s seem to have combined all the
enic offences of its day. To sum up we
certain facts which seem to point in
rticular direction. Plague does not,
rently, thrive in the soil, nor is it
wn to enter the body with the food, in
an cases at least. In the ordinary
—excluding plague pneumonia—it
rs by the skin, and in the bubonic
it certainly enters in the lymphatic
drained by the first affected gland. Water plays no part in its dissemination. Meteorological factors have no influence except in one significant indirect instance—that in India the plague mortality is noticed to rise materially after a cold night, or a heavy fall of dew, and especially after rains during the dry season, whereby people are driven into their homes instead of sleeping outside as usual. Clothing is apparently capable of conveying the disease; but the bacillus is not recoverable from clothing. And lastly, a marked association of the rat with plague outbreaks has been noticed since remote periods in parts of the world where the rat flea closely resembles the human flea, and no such association where the rat flea shows, at any rate at the present day, wide structural differences from the human flea.

This circumstantial evidence appears to incriminate the insect, but circumstantial evidence is not enough. Dr. Simond, in 1897, had proved that by infecting into a mouse broth in which fleas had been emulsified, after having fed on a plague-stricken animal, plague could be produced in that mouse. This experiment was successfully repeated on several occasions by myself and others, and the results obtained were sufficiently encouraging to induce further work. Fleas of certain species were fed on plague-infected animals, and after varying periods of starvation were allowed to bite healthy rats under conditions which excluded any probability of the disease being contracted otherwise than by flea-bite. These rats died of undeniable plague, and it was found that the flea could convey plague in this way up to at least three days after a meal of infected blood. There is no reason why it should not do so for very much longer. It was found that in one case, at least, this conveyance from rat to rat was effected by a human flea. In other cases the rat-pulex was used. A further experiment was performed in which plague was conveyed from a human being to two rats by means of fleas. This latter experiment was of especial significance, since, on subsequent examination, it was found that while three of the insects used for the purpose were the pulex palladus of rats, one was a pulex irritans, or human flea. By cutting the insects in sections after a meal of infected blood, and examining them under a microscope, large numbers of bacilli indistinguishable from plague bacilli in their microscopical characteristics, were found in a peculiar organ forming a part of the œsophagus ; while in fleas, which had been fed on healthy blood, no such bacilli were found.

The work which I have alluded to was performed in India certainly with all the facilities of one of the biggest bacteriological laboraties in the world, but without much assistance from special literature on the subject, for the very good reason that none existed to indicate the technical difficulties to be overcome. As you may readily imagine, these were considerable, for to secure such an active and minute creature as the flea in such a manner as to allow it to feed, and yet to ensure that it should not get away after its dangerous meal of plague infected blood, was an operation of no little difficulty, and also of some danger, both to the experimenter and to his neighbors. After a good deal of trial, the device was hit upon of confining them in a glass tube—an ordinary test tube was used—and covering the open end with a cap of fine gauze, through the meshes of which the flea could protrude its proboscis, but could not escape. This difficulty overcome, it was necessary to find some distinguishing marks by which to identify the species used. This was affected after a time, and the few species employed were readily enough identified.

The habitual spread of plague by fleas of the type I have shown you is not to be taken as a universally accepted fact, but strong evidence exists that this will eventually prove to be, at any rate, an important factor in epidemics.

You may recollect an allusion made to the work of Dr., now Sir, Patrick Manson, in relation to certain blood worms, which are fairly common amongst human beings in the tropics. No less than five different kinds of these worms are known, and one in particular, the filaria nocturna, so called because it is only found in the blood during sleeping hours, is of particular interest, in that it causes a good deal of illness by blocking up the delicate lymphatic ducts, and is almost certainly in this way the cause of that strange disease elephantiasis. Filariae occur amongst other tropical and subtropical places in Queensland and Northern Australia to about the latitude of Brisbane, and the manner in which the filaria nocturna completes its life cycle is of interest. The parent female worm is some 4in long, and lives in some part of the lymphatic system, in company with the male, which is slenderer and smaller. There she produces a great number of embryos, which make their way into the blood, and live during the day in the vessels of the internal organs. About 5 or 6 p.m., in infected persons who do their sleeping at night, they begin to appear in gradually increasing numbers in the peripheral circulation, or vessels in the extremities and at the surface, increasing till about midnight, and then decreasing, until about 8 or 9 in the morning they have all disappeared from the peripheral blood for the day. It is a curious fact that in infected persons, who do their sleeping during the day and remain awake at night, the embryos reverse the time of their appearance, and turn up during the day in the peripheral vessels, disappearing at night. Each embryo is about 1·80in long, and is contained in a loose sheath or sack somewhat longer than itself. They are very active organisms, and wriggle about strongly, but the sheath keeps them from changing their position much ; in other words, they are not locomotory. The function of the sheath is to keep them from using the strong boring apparatus which they have on their heads, and so escaping from the blood vessels. As I have said, they appear in the surface blood vessels at night as a rule, and this is obviously for the convenience of the conveying mosquito, which principally feeds at night, and into whose stomach some of the embryos are taken with the meal of blood. The ordinary mosquito so acting is a species of Culex, and in its stomach the blood becomes much thicker by coagulation. The embryo within the sheath is thus able to get a purchase on the sheath, and eventually to ram its way out through one end by butting vigorously while the sheath is stuck fast in the thickened blood. Of course, while the blood was fluid in the human host's vessels, it could not do this because the sheath could only be bumped along by its efforts from within and would not split.

Once loose it bores through the stomach wall of the mosquito, gets into the muscles, and changes its form very considerably. Finally, after some 16 days, it appears in the head and proboscis, not in the poison glands as did the sporozoites of malaria, but coiled up under the pharynx and in that part of the proboscis known as the labium. They can remain here for an indefinite period awaiting the chance to pass into the tissues of a warm-blooded vertebrate when the mosquito takes its next meal of blood. Apparently they can discriminate, for no amount of feeding of the insect on bananas or other fruit (upon which it ordinarily subsists, will cause them to come out. When, however, the insect sticks its proboscis into a human being the filariae find their way through a weak spot which exists in the labium where the labellae splay out, and pass along the track of the proboscis into the tissues of the victim. The filariae apparently endeavor to emerge in pairs, male and female, and upon establishing themselves in the tissues of their new host, they set up housekeeping, and begin again the process of which we know the results under the name of the filariasis, be it elephantiasis or any of the other peculiar conditions by which we recognise the blocking of the lymphatic channels by their offspring.

I trust that I have been able to give some indication of the very prominent part played by certain insects in certain exotic diseases, but there is little doubt that they also assist in disseminating others which are with us already. The ordinary house fly is ubiquitous in its habits and unpleasant in his history and associations. That it is capable of conveying on its feet and body the germs of disease under experimental conditions has been demonstrated. and that it frequently does so in nature is freely admitted. In a more enlightened age the housewife will regard flies with the same horror and disgust as she now regards bugs and fleas, and most thinking folk will even now cordially agree with her in theory if not in practice. From the time in which it is engendered in a heap of manure to the fateful hour in which it commits suicide in the milk jug, or perishes in the sticky recesses of the summer butter pat, the life of the average fly is passed amidst more than questionable surroundings. Its ubiquity renders the whereabouts of its last alighting place a subject for uncanny speculation when it settles on an article of food, and I have little doubt that domestic flies, so-called, are responsible for a fair proportion of cases of communicable disease, especially perhaps of typhoid fever. Its possibilities, however, do not end there; exanthematous diseases, especially perhaps smallpox, may be readily conceived as spread by this means. I confess in fact to a doubt as to whether the real cause of the aerial convection of smallpox is not partly or wholly due to insect life. Many points in the available evidence upon it appear to render such a hypothesis tenable, and fly-proof door and windows coverings should certainly form a part of the furnishing of isolation hospitals for this disease.

The possibilities of this line of research are, however, boundless, and in time to come the labors of the biologist and naturalist will become of more and more importance from the standpoint of human disease. The extension of research in connection with cancer in the lower animals has resulted in its discovery in a large number of creatures, including even fish. Similar results have been obtained with the tubercle bacillus, whose range appears to be practically universal. The diseases of which I have spoken to-night do not by any means include all those in respect of which insects are known, or suspected, to play an important or essential part, but they will serve as illustrations of the pioneering work which has been, and is daily being done by many investigators in different parts of the world for the benefit of humanity and the advancement of civilisation.

The lecture was illustrated by lantern slides.

# OBSERVATIONS REGARDING SOME ECONOMIC ASPECTS
## OF THE
# EISENACH SOCIAL EQUALITY PROGRAMME.

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By R. M. Johnston, I.S.O., F.S.S.,
Government Statistician, Tasmania.

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(Read 13th June, 1904.

my previous contributions to the
l Society of Tasmania dealing with
y " Root Matters in Social and
omic Problems," I have elaborately
with questions touching the condi-
affecting the production, accumula-
distribution, and consumption of
h. These, together, occupy too large a
for even a passing review in a simple
ss, and therefore I have restricted
bservations this evening to " Wealth
ts Distribution," as at present in the
d Kingdom and in the Common
h of Australia.

fore dealing with this aspect of what
med to be a most important part in
cialistic programmes, it is absolutely
tial that we should at the outset
stand the true meaning of the terms
e. For example, even if we exclude
e must do to reason correctly) the
r unmonopolised gifts of Nature—
as air, rain, and sunlight,—which
no element of " price " or " exchange
," there are still, at least, three
ent conceptions of the phrase, "The
th of a Country," the lack of a pre-
grasp, of which, is the rock upon
the extreme wing [illegible] Socialists
Eisenach, Got[illegible]
e wrecked in [illegible]

Statisti[illegible]
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seldom more than 2 to 3 per cent. of the corresponding total *capital value* of the true wealth in exchange intended for actual consumption and enjoyment by either capitalist or wage-earner.

The so-called "Statistician's wealth," to which attention of Social Reformers of existing individualistic democratical organisations is invariably restricted excludes the primary source of all wealth in exchange (consumable wealth) viz., the existing productive personal services of man (Karl Marx's labor unit), although the annual monetary effective value is fully three times as great. For example, in Tasmania the annual value of wealth produced and actually devoted to consumption and personal enjoyment or satisfaction is estimated at present to be equivalent in money to £7,796,000. This annual wealth, mainly the direct product of man's personal services and of his auxiliary machinery of production, must therefore have at least a bona fide capital value of, say, £155,920,000; whereas, at most, the fixed capital wealth, the Statistican's wealth, or the inanimate and other forms of the auxiliary tools and machinery of production, only amounts to about £40,000,000, or merely 25·65 per cent. (nearly a fourth) of the actual wealth available to capitalist and wage-earner alike for the purposes of consumption and enjoyment.

[illegible]ilarly we have for the following
[illegible] a corresponding analysis of their
[illegible]ingly, as we refer the term
[illegible]y differing conceptions
[illegible] phrase or term is often

## THE WEALTH OF THE COUNTRY.

|  | AUXILIARY. Tools and Instruments of Production (Capitalist's or Fixed Wealth). |  | CONSUMABLE WEALTH. The Product of Current Labor, Skill and Auxiliary Tools of Production. |  |
|---|---|---|---|---|
|  | A Capital Val. Mil. £. | B Annual Val Mil. £. | C Capital Val Mil £. | Annual Val. Mil. £. |
| ABSOLUTE. |  |  |  |  |
| United Kingdom ... ... | 15,000 | 750 | 35,000 | 1,750 |
| Commonwealth of Australia... | 912 | 45·6 | 3,706 | 185 |
| Tasmania ... ... ... | 40 | 2 | 155·9 | 7·8 |
| CENTESIMAL. |  |  |  |  |
|  | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| United Kingdom ... ... | 42·87 | 2·14 | 100 | 5·00 |
| Commonwealth of Australia... | 24·60 | 1·28 | 100 | 5·00 |
| Tasmania ... ... ... | 25·65 | 1·28 | 100 | 5·00 |

### WEALTH IN CONSUMPTION.

When the Socialist complains of the unequal distribution of wealth, such is the confusion arising from the various applications of the term, that he is often misled by references to facts which have, at best, only a partial relation to the subject to which his attention is particularly directed.

If he bases his conclusions on the "Statistician's Wealth," and especially so when restricted to the Statistician's Estimates—of the capital value of the private wealth of the country—he is sure to be misled; for the Statistician's figures do not embrace any element of wealth which, during the year, is utilised or devoted to the immediate consumption or satisfaction of man, nor for the immediate consumption of man's auxiliary aids and instruments engaged in the work of reproduction.

They are confined strictly to those articles of wealth which are fixed or set apart from consumption as instruments for the production, transfer, modification, or protection of the current year's consumable goods and satisfactions for man himself; and also for the current year's supply of consumable goods, required as food, renewals, repairs, and shelter by man's instruments, whether animate—as horses, cattle, sheep—or inanimate—as in the coal, oil, and other materials required for the production of energy in his engines and machinery, engaged constantly in the production, transfer, or modification of the essential utilities of man's life—viz., food, transport, shelter, warmth, clothing comforts, luxuries, ease.

Moreover, the Statistician gives the capital value of these instruments; and therefore no just comparison between this personally non-consumable part of a nation's wealth can be made, until the several parts of the total wealth are stated in a corresponding measure of monetary or exchange value.

For if we capitalise the value of fixed instruments, we should also for comparison capitalise the annual production of wealth —also annually:—

(1) Distributed and consumed; or (2) annually converted into fresh fixed auxiliary producing, transporting, modifying, or protecting instruments.

Thus, although the capital value of fixed instruments in the Australian Commonwealth is estimated at 912 millions, it only represents 24·60 per cent. of the corresponding capital value of its annual production of fresh wealth of consumption; for although the annual value of the latter only represents 185·84 millions, its capital value represents a sum £3706 millions, or 4·06 times the value of the Statistician's wealth of lands, houses, machines, and other fixed forms of the mere producing agencies.

Even while it is admitted that the element of national wealth contained in the fixed producing instruments (viz., 24·60 per cent.) may be confined to the ownership—not consumption—of a comparatively small number of the community, this circumstance does not afford the

test information as to the distribution
he fruits of the various producing
cies, among which man's current
cting as well as current muscular ser-
s play a prominent part; and it must
be forgotten that the latter, together
the "anterior labor" and skill of man
currently stored or incorporated as
ched claims in auxiliary producing in-
ments, constitute the main elements
ch give price or monetary value to the
ent wealth in exchange, produced,
ther for consumption or for fixed uses
ture production.

rom such obvious considerations we
able to detect the common fallacy
ng Socialistic writers and others, who
riably measure the distribution of the
lth created purposely for human con-
ption and personal satisfaction among
wage-earning classes by the propor-
which the ownership of fixed or
opelised capital-producing instru
ts, etc., show among the people
rally.

he fallacy, however, is so thoroughly
rwoven in the literature and sayings
e mass of the people that it is almost
ossible to expose its absurdity; but
n we consider that man lives by
ent or annual productions *per se*, and
upon fixed capital or their nominal
ies, whether annual or capital, and
n, moreover, we discern that services
ently rendered, whether by instru-
t, skilled mind or hand, constitute the
of what forms the purchasing power
laim over wealth being produced for
umption and personal satisfaction, it
ly then we are able to perceive that
distribution of real wealth, so far as
's needs and satisfactions are con-
ed, is determined, not as fal-
usly assumed by the proportion of
ership which each man holds of the sta-
cian's wealth—*i.e.*, the fixed non-
onally-consumable instruments, and
ch the owner no more consumes than
servants who control them—but
tly by the express measure which
ices of various degrees of exchange
e have enabled each worker to consti-
a claim upon the aggregate of all
services whose values are con-
ed and incorporated in the current
uction of actual wealth.

is not here contended that the time
r of each individual laborer or instrument has the power to create equality of claim in correspondence with time effort; that is too obviously unequal; but it is contended that every such effort, usefully directed, constitutes a definite claim. and, therefore, the true distribution of wealth in the community—wealth in consumption being the major factor—can alone be accurately determined by the average annual earnings or claims upon wealth. The proportion of fixed wealth owned by individuals affords no clue to current distribution of total wealth. It can merely show how the 24·60 per cent. devoted to fixed instruments is distributed.

If the proportion be large it insures probably a claim to the extent of 4, 5, or 6 per cent. of his (†) capital upon real wealth, upon which the owner exists, and which may give a considerable purchasing power to the individual without any current personal exertion; but it must not be forgotten that the fixed capital of a manager may be almost nil, while his skilled directing services may enable him to create a yearly claim of £1000 value upon wealth produced for immediate human uses, while the fixed instrument of a helpless widow, owner (say) of £10,000 capital value, may only afford her a claim of half the amount (or £500) falling to the manager, whose fixed capital is reckoned as nil in the usual Statistician's estimates of the capital wealth of a country.

It will be seen, therefore, that what is termed "the enormous accumulations of wealth in our times," "the riches of capitalists," do not consist of fine houses, luxurious equipages, money, or grand parks, or, if so, it only forms a most insignificant portion of it. The great bulk of the nominal and real wealth of capitalists consists of land improvements, mines, railways, tramways, ships, canals, stores, warehouses, manufactories, machines, tools and instruments, etc.,

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(†) The State in itself in the Commonwealth of Australia is already in the possession of its lands unalienated, its railways, telegraphs, roads, and public buildings; and therefore is now the largest owner of fixed capital wealth, and would, if extended, become the sole owner, if the more practicable programme of collectivists were possible.

themselves; and though rightly included in the aggregate fixed wealth of a country by statisticians, these do not in any sense enter into the personal consumption of the rich owner any more than they enter into the personal consumption of the workman engaged in connection with such forms of national wealth.

The mass of Socialist writers wish us to infer that the "toil" of the "masses," "the lower ten millions," alone "is the active factor that produces all wealth." Entertaining such a view, it is not remarkable that they should regard the riches of the "upper ten thousand" as a hoard mysteriously and wrongfully abstracted from the forces actively engaged in producing wealth.

If by the toil of the masses they mean that all the physical forces requisite to transport and transform natural materials to suit the needs of man, they are manifestly wrong; for (exclusive of the mere gratuitous forces of Nature, such as natural chemical changes, multiplication by the mysterious forces of life, sunlight and heat forces, gravitation, the rain, dew, and the fertile soils, and the animal, vegetable, and mineral products in their natural state and position) there are the active forces set in motion, not of the expenditure of muscular energy, but of mental and moral force, exerted by men of forethought, of skill, of invention, and of the provident who designedly saved from immediate personal consumption, and devoted such savings purposely to the construction of mechanical and other aids devised or discovered by skilled minds, whereby the forces of Nature, such as gravitation, chemistry, steam, water, wind, electricity, leverage, lower animals are so captured, tamed, and drilled, that they now exert a physical force in the production of man's wealth—whether in the way of transporting from place to place, or in transforming materials from the natural raw state to the highly finished—compared with which the brute or muscular force actually exerted by all the working men of the globe, forms the most insignificant fraction.

The brains of man can alone be credited with invention and discovery, not his muscular power. It is to the accumulations of savings from personal consumption by the laborers and others of former times that we are indebted for the necessary stores devoted to the construction of the powerful and ingenious mechanical and other labor-saving auxiliaries now engaged in aiding the current labor of man, and not, as falsely assumed, to the mere muscular energy and labor-time exerted and devoted by those who happen to be the laborers or workmen of the present hour.

Recent estimates of the measure of energy exerted each year in the production' distribution, and necessary modification of consumable wealth—the satisfactions of man, by capitalist's steam power machines alone—are approximately equivalent to the maximum energy of about 1500 million persons, of whom it is estimated that there are only 600 million breadwinners. We may be perfectly safe in assuming that the energy exerted by all classes of capitalists' auxiliary machines, including those already in the possession of the State as such, to be equal to the maximum energy of 1200 million breadwinners, *i.e.*, equal to twice the physical force of all living breadwinners of the globe. In the Commonwealth of Australia at present the number of breadwinners under £150 income per year number about 1,709,000 persons. These, for purposes of illustration, may be safely taken as the wage-earner group. The breadwinners £150 income per year and over, numbered 135,000; and this group, for rough purposes of comparison, may be taken to represent the capitalist group. Now, if the capitalists' energy machines engaged in the production of consumable wealth be taken to represent no more than twice all the available force of man, their equivalent in the Australian Commonwealth would be represented by about 3,418,000 breadwinners, thus:—

Relative Value of Physical Energy exerted by the various agencies engaged in the production of Consumable Wealth:—

| | | Per Cent. |
|---|---|---|
| A — Breadwinners under £150 ... | 1,574,000 ... | 80·70 |
| B—Capitalists and others over £150 | 135,000 ... | 2·63 |
| C—Capitalists' energy machines | 3,418,000 ... | 66·67 |
| Total energy employed in the production of consumable wealth ... | 5,127,000 ... | 100·00 |

From this table we perceive that if we ignore the claims of intellect and ability, and restrict our attention to the mere physical forces devoted to the production of consumable and other forms of wealth, the wage-earner's contribution only amounts to 80·70 per cent. of the whole of the necessary energy required to produce that volume of consumable wealth which would yield each class and individual that standard of living and comfort to which they have been accustomed.

Now, if it can be shown the wage-earner group (under £150) receives a larger proportion of the consumable wealth in each year than the proportion of physical energy contributed by such in its production, it most effectually disposes of the sentimental complaint so frequently put forward by the Fabian school of writers, viz., "the lower ten millions, whose toil is the active factor that produces all wealth, not of the upper ten thousand, who in some mysterious way manage to get rich upon that toil."

This inaccurate statement can easily be refuted in a very simple manner by ascertaining what proportion of consumable wealth, per year, is appropriated or absorbed by the three principal agencies engaged in its production. The best and surest means to gauge what measure of reward comes to each separate group is to determine what proportion of the total annual income is appropriated by each group respectively.

This has been very closely determined by the writer so far as Australia is concerned, and is shown in the following table relating to distribution of the national income for the year 1903:—

Share of National Income appropriated or absorbed by the various agencies employed in the Production of Consumable Wealth.

| Producing Agencies. | Comparative value of physical and other energy exerted in the production of consumable wealth. | | Approximate share of title to consumable wea'th absorbed or appropriated by the various agencies engaged its production. | | | |
|---|---|---|---|---|---|---|
| | Energy Equivalent | Per cent. | Amount. | Per cent. | Per unit of energy per working day. | Per cent to average unit. † Above. * Below. |
| | | | £ | | s. d. | |
| By breadwinners, under £150 per annum ... ... | 1,574,000 | 80·70 | 124,662,000 | 67 26 | 5 8 | †119·1 |
| £150 and over (capitalists' class) | 135,000 | 2·63 | 23,980,000 | 12·94 | 11 10 | †891·4 |
| By capitalists' steam and other auxiliaries ... ... ... | 3,418,000 | 66·67 | 36,700,000 | 19 80 | 0 9 | *71·8 |
| Total ... ... | 5,127,000 | 100 | 185,840,000 | 100 | 2 5 | 100 |

A careful study of this table shows that, so far from the capitalist class being enriched at the expense of the wage-earner, the very opposite is the truth; for instead of a reward being allotted in proportion to his share of physical energy contributed, it has been increased fully 100 per cent.; physical energy expended being only 30·70 per cent., while his share of rewards represents 67·26 per cent.

This improvement of his position is solely due to the fact that the more economic physical agent engaged in production only absorbs 19 80 per cent. of the consumable wealth, while its share of the necessary energy engaged in production amounts to 66·67 per cent., or two-thirds, at least, of all physical forces (human or other) engaged in the production of the year's necessary wants and satisfactions. It is true the private capitalist receives, relatively, a larger *individual share* of the capitalist's own machine production; but it is impossible for him to personally absorb more than about three times the amount of the average breadwinner. The higher the percentage of energy, contributed, usefully, by the capitalist's machines involves, of necessity, a corresponding greater bonus reward to the ordinary breadwinner, while the proportion going to the capitalist, as such, must by a like necessity, remain almost stationary in comparison.

It cannot be too strongly asserted, therefore, that the greatly increased reward of the laborer of the present day in civilised countries is mainly due to the increasing command which during the last century man has obtained over the forces of Nature.

Steam, electricity, and the ever-increasing improvements in labor-saving machinery has multiplied the effective force of man's mere muscular power in the production, transport, and manufacture of necessaries and satisfactions, three to four, and, in some cases, many hundred-fold. In proportion as these auxiliaries have increased as aids in the production of any one necessary service or commodity, the amount of physical human labor engaged has decreased individually, while the real reward of labor has on the average increased by about 50 per cent. Nothing can be more conclusive than that it is to the consequent liberation of the proportion of labor, formerly necessary to produce the barest primary essentials of life, that we are indebted now for the vast category of new comforts and satisfaction, the attainment of which was utterly impossible to the mass of human beings, when the production of food alone—the great primary industry—absorbed nearly the whole of man's muscular efforts and his time.

### EXISTING DISTRIBUTION OF SHARE OF PRODUCTS AND SERVICES REGARDED FROM THE DEMOCRATIC SOCIALIST POINT OF VIEW.

Having thus attempted to clear away some of the confusion so frequently introduced in discussions bearing upon wealth and its distribution under the existing democratic individualistic or wage system form of modern society, we come now to consider how far the distribution of consumable wealth (i.e., the annual aggregate of products and services) departs from the ideals of division or appropriation desired by the leaders of the communistic or collectivist form of socialism.

It is difficult to trace any clearly defined positive programme among the average persons who espouse the adoption of any of the forms of communist socialism, or collectivism, as it is now frequently termed. We may here dismiss from our view the more extremely visionary, or impossible, forms of communistic ideals, and restrict our attention to the first of the two most notable sections, viz., the "Eisenach" and "Gotha programmes. The one, the "Eisenach' programme of 1869—according to the learned authority, Dr. Schaffle—demanded on the basis of national ownership of all the means of production that each workman should have secured to him "the full product of his labor" in the counter-value which accrues to him. This was the collectivism of an accurate apportionment of income and enjoyment according to work performed. But as early as 1875, in the "Gotha" programme, there came to the front the collectivism of apportionment according to need, on the basis of an equal and universal obligation to work, that is to say, pure collectivism: for this demand was literally formulated for "universal obligation to work, and the equal right of all to the satisfaction of reasonable needs!" Both of the s have been ably demonstrated by Schaffle to be Utopian, and impos- of achievement, as amongst other s they altogether fail to cover the mstances requiring provision for the of the family with its sacred ties; are of the young, the aged, the sick ippled who are unable to work, and ring also adequate provision for ng with the idle, the dissolute and nal, who have no desire to perform of any social value.

### UTOPIAN SCHEMES OF SOCIALISTS.

is not a matter of surprise that the of struggling wage-earners should adily sympathise with any vague ian scheme of the Socialist, which, ver faulty, holds out some promise n for dealing more effectually with ifficulties which affect them most y, viz., security of employment; ction from over competition; er hours labor, with more adequate neration; redistribution of wealth; ge pensions, etc., etc.

t it is needless to point out that redistribution on the basis of ity, of the aggregate of all forms of h in exchange, can be considered, st be clear that this wealth consists h forms as might effectually satisfy e primary wants and comforts of n beings. That existing wealth in nge, even if equally distributed, fulfil this most desirable end, is a ssumption.

as already been shown that a great f the existing nominal wealth in ex- e largely appropriated by the private lists—consists of the mere *tools* and *ments* of production, and that the ealth, appropriated as consumable or primary satisfactions, is already widely and evenly distributed than erally supposed. Even under the thorough Socialistic scheme this f wealth would be far less gener- istributed than at present; for, ac- g to such a scheme, it would be reserved in the hands of the Ex- e Government. It is utterly ding to reckon upon the existing of capitalists instruments of pro- n as a source of raising the quota e real consumable and primary ctions. The only distribution le in this respect would be the empty idea of part ownership. It is the increase to necessary current productions *designed for actual consumption*—material satisfactions—which alone can raise the average standard of primary satisfactions, and so dispose of material want, or poverty and distress. The question therefore arises:—Suppose that such a scheme were practicable, would the producing energies of men be greater and more effective than under the Scheme of Competition, Liberty, Right of Inheritance, Property Right, or Individualism, as it is called? To be more effective in one essential it must utterly fail in the other. The workers must be trained and allocated to specific occupations in strict conformity to the amount and nature of the labor actually required to produce the primary satisfactions and comforts desired. Training for every specific occupation requires considerable time; but for the occupations of skill a large amount of time must be consumed in acquiring the necessary training, irrespective of questions with regard to the unequal distribution of capacity.

Now on the basis of equality it may be easy to divide products; that, according to actual needs is simple enough, involving no insuperable difficulty. But what about the allocation to different employments? How can the easy, the refined, and the skilled occupations be allocated on any scheme of equality? The majority must, as heretofore, sweat at the hard and dirty forms of labor. But what power, or what plan can be devised which will enable any elective executive to doom once and for ever the majority of learners and workers to the hard and irksome occupations, and to fix the minority in the refined, the easy, and skilled services?

Suppose it were for a time instituted how long would the unfortunate majority be content to submit to their lot before an irresistible cry for *redistribution of occupations* arose; and if it arose, where is the force stronger than the majority of freemen to prevent the breakdown of the social organisation necessary to produce the supply of primary satisfactions according to individual needs? What compensation can be given to the masses toiling in the more wearisome occupations? Extra allowance of satisfactions cannot be thought of, for that would destroy the coveted ideal of equality in the distribution of satisfactions according to needs. Shorter hours cannot be allowed without trenching upon equality of leisure.

The unequal distribution of natural capacity, and the time necessary to acquire knowledge of more than one technical branch of skilled employment, make it impossible to share in turn for a time all possible forms of labor. In short, the practical difficulty standing in the way of *equality* in the *allocation of employments* appear to be insuperable, and would most certainly, if there were no other objection, destroy any social organisation on a *large scale* which had been courageous enough to attempt it. Reference to simple communities—as in America—following agricultural pursuits mainly, and not of themselves fulfilling for themselves the whole round of human wants, are utterly misleading. Such small communities are composed of a peculiar select class, who voluntarily bind themselves to a more or less ascetic life, and all such partial attempts tend to perish from lack of internal vitality. With a large mixed body of men embracing all occupations and endowed with ordinary passions and desires, the results would be chaotic and disastrous in the extreme.

One effect, terrible to contemplate, would seem to be inevitable, viz., that the indiscriminate distribution of products among all men would tend to destroy the major source of savings at present so largely devoted to the creation and maintenance of the powerful and costly auxiliary aids to human labor, which would be jealously regarded as a grievous tax burden. The slight individual gain per head in material satisfactions at the outset would only be of a very temporary character, for it would soon be lost by the new impulse given to the improvident to rapidly increase their numbers.

### HOW THE CONSUMABLE WEALTH OF PRODUCTION IS DISTRIBUTED IN THE UNITED KINGDOM AND IN THE COMMONWEALTH OF AUSTRALIA BY THE INDIVIDUALISTIC AND ONLY PRACTICAL METHOD OF DEMOCRATIC SOCIALISM.

The difficult problem connected with all ideals as to the realisation of the best form of social organisation, whether vidualistic or communistic, should not examined without a clear idea of what is and what promises to be conserved of that which we hold most dearly under the democratic system of practical Socialism under which we now exist.

It would be impossible to deal with this most important consideration adequately within the limits possible in a brief address of this nature, but if it be possible to show that the actual fruits of production are—notwithstanding the large monopoly of the auxiliary instruments of production in the hands of private capitalists—now more widely and evenly distributed than is generally supposed, I shall have done something to aid those who have not always the time to study closely the great socialistic tendency of the present day.

I begin this aspect of the question with the following assertions :—

(1) That no matter what may be the monopoly of the *Fixed Instruments of Production*, whether in the hands of private capitalists, or, as in some cases—State railways, roads, and a large proportion of the lands—under the control of the State, the reward absorbed by capitalist and pure wage-earner alike cannot by any means exceed the actual effectual yield of commodities and services of any one year.

(2) That if the whole of the fixed machinery of production were now transferred to the State it is doubtful if the yield of products in the aggregate for distribution, whether of commodities or service, would be increased ; for the reason that the control and efficient maintenance of the necessary instruments of production would be wholly excluded from individual consumption. and the cost of the creation of new instruments, and maintaining the existing machinery, would have to be taxed or abstracted from the gross yield of the year.

(3) That if we desire to avail ourselves of the advantages hitherto gained by society as a whole from intelligent, directing, and inventive skill, from special aptitude, from special technical training, and other rarely distributed qualities engaged in various forms of production, we must, as at present, be prepared to bestow, from the general fund of products and services, some measure of special inducement to continue these advantageous efforts on behalf of society as a whole.

we fail to do so there will certainly
ıtroduced a tendency to lower the
ty and effectiveness of all human
engaged in the necessary work of
ıction, and, in time, would result in
er average level of production than
ıw enjoyed by the average of the
ıt level of the existing social organi-
ı.

th these general observations in
let us examine, as closely as we are
the actual measure of production
ble for distribution in the Australian
nonwealth in the year 1908, and
mode and measure in which it has
distributed among the various classes
eadwinners—rich and poor, capitalist
wage-earner:

r the Commonwealth of Australia for
year 1908 there were actually en-
d in the work of production and other
isite social services of a personal
:—

Auxiliary fixed instruments, etc.,
ıg economically an effective capital
of £912 millions and an annual
s of £45·60 millions.

Skilled industrial chiefs: techni-
trained professional men, artisans,
and common labor, embracing
,000 breadwinners, representing the
population, whose capital value in
work of production is estimated at
6 millions, with an annual produc-
value of £185·84 millions.

*w labor*, minus directing mind and
ed technical skill, may be considered
n a plane with the useful effective
of the myriad physical forces incor-
ted at the present day in the various
iary instruments the fruit of many
ıtive minds, so far as they are con-
d as effective agents towards the
ssary aggregate of production. But
ıst be borne in mind that those im-
ınt auxiliary instruments, alone, at
contribute fully two-thirds of all
physical force or energy towards the
ssary production and services of
ty. When, on the basis of average
time energy, on the Karl Marx
ry of distribution, it is asked: Does
average human instrument of
ical labor receive anything like
fair share of the year's production
mmodities and services? the reply
rding to statistics of distribution is
ıot only does the actual laborer of
the year, as such, receive his fair reward for his proportion of *physical effort* expended in the work of production, but owing to the natural limitations to powers of consumption of both capitalists and the auxiliary instruments owned by them, the reward of labor, as a whole, in proportion to *mere physical effort* expended, is enhanced by more than 100 per cent.

It is manifest, notwithstanding these considerations, that the total productions and services of the the Australian Commonwealth in the year 1908, representing in money £158,340,000, have not been equally distributed. Upon the whole the aggregate of £185,840,000 represents a sum of 6s 11d per breadwinner, and was approximately appropriated as follows:—

DISTRIBUTION OF CONSUMABLE WEALTH. THE PRODUCTS OF THE YEAR 1908 IN AUSTRALIA.

(TOTAL PRODUCTS AND SERVICES £185,340,000. PER BREADWINNER PER WORKING DAY, 6s 11D.)

INCOMES OR WEALTH.

ABSORBED BY.

| | No. of Bread-winners | Per Cent. | Per Breadwinner Per Working Day. s. d. |
|---|---|---|---|
| Incomes under £100 | 1,399,000 | 81·86 | 4 8 |
| „ £100 to £125 | 102,000 | 5·97 | 7 3 |
| „ £125 to £150 | 73,000 | 4·30 | 9 0 |
| „ £150 to £200 | 46,000 | 2·71 | 10 4 |
| „ £200 to £400 | 69,000 | 4·01 | 17 0 |
| „ £400 & over | 20,000 | 1·15 | 113 3 |
| | 310,000 | 18·14 | |
| Total ... | 1,709,000 | 100 | 6 11 |

| | No. of Bread-winers. | Per Bread-winners Per Working Day. s. d. |
|---|---|---|
| Less absorbed by products, etc., in the creation of and maintenance of necessary auxiliary instruments of products, with an estimate physical effective force of 3,418,000 bread-winners... ... | 3,418 000 | 1 0 |
| Total average level of products and services absorbed by actual breadwinners ... | | 5 11 |

From these figures it will be seen that if the whole of the products and services available for consumption or use were distributed equally, without regard to the skill or effectiveness of the individual breadwinner, all persons receiving more than 5s 11d per working day would, by communists, be regarded as robbers of a privileged class, and those receiving less as belonging to the exploited or unprivileged majority. These classes, so far as groups are concerned, would absorb under or over the level of equality (5s 11d per working day) as follow :—

| | Per Working Day. | | | |
|---|---|---|---|---|
| | Above Level of Equal. | | Below Level of Equal. | |
| | s | d | s | d |
| Incomes under £100 | — | | 1 | 3 |
| ,, £100 to £155 | 1 | 4 | — | |
| ,, £125 to £150 | 3 | 1 | — | |
| ,, £150 to £200 | 4 | 5 | — | |
| ,, £200 to £400 | 11 | 1 | — | |
| ,, £400 and over | 107 | 4 | — | |

It would appear, therefore, if equality of reward should come to be regarded as the ideal of the people of the Commonwealth of Australia, that the skilled artisans and others as a body would have to pay into the pool quite as large an amount in the aggregate as the richer capitalist, to give the lowest group £100 per year the necessary 1s 8d per working day to raise it to the uniform level of equality of reward, viz., 5s 11d per working.

These conclusions, also illustrated by accompanying tables and diagrams, show that wealth available for consumption and enjoyment is more equitably distributed than is generally supposed, and whatever may be its existing inequalities and defects, it is immeasurably superior to any scheme of communism or collectivism that has ever been attempted or formulated. The programme of the Trades Unions, and the more intelligent of the Labor Party in the United Kingdom and Australia, are antagonistic to all the extreme communistic ideals of socialists. They, of course, advocate an extension of the idea of State ownership of the more important branches of industry, but it is upon individualist lines strictly not communistic. Liberty, responsibility, skill, effective labor and reward, in accordance with ability, has ever been the ideals of the best representatives of labor in England and in these colonies.

## APPENDIX.

### ANNUAL INCOME OF ALL BREADWINNERS IN THE UNITED KINGDOM AND IN THE COMMONWEALTH OF AUSTRALIA.

The following tabular illustrations have been carefully prepared, based upon the most reliable official statistics, with the object of showing approximately the annual value and distribution of all wealth produced, designed for consumption and for the satisfactions of the people. Also showing, approximately, the result to each class of breadwinners, on the assumption that it would be practicable to Pool, and divide the incomes or equivalent products of all breadwinners equally according to the Eisenach Programme of Social Equality, after deducting the necessary materials (estimated at 15 per cent. of annual products) to provide the government of the social State, with means to create and maintain the existing inanimate and other auxiliary instruments of production necessary to keep up the required standard of comforts and satisfactions :—

UNITED KINGDOM ° (000's Omitted).

| Class | Breadwinners. | | Income. | | | Income if Pooled and Distributed on the Eisenach Programme of Equality. | | |
|---|---|---|---|---|---|---|---|---|
| | No. ° | Per cent. | Amount ° | Per Cent. | Per head per work. day. | Amount ° | Per Head Gain from Pool. | Per Day. Loss to Pool |
| Incomes: | | | £ | | s. d. | £ | s. d. | s. d. |
| Under ... ... £100 ... | 15,262 | 82·76 | 765,000 | 43·71 | 3 2 | 1,231,055 | 2 0 | ... |
| £100 and under £125 ... | 1,114 | 6·04 | 125,900 | 7·20 | 7 3 | 89,845 | ... | 2 1 |
| £125 „ „ £150 ... | 800 | 4·34 | 112,200 | 6·42 | 8 11 | 64,557 | ... | 3 9 |
| £150 „ „ £400 ... | 1,093 | 5·94 | 237,100 | 13·54 | 13 10 | 88,358 | ... | 8 8 |
| £400 and over... ... ... | 169 | 0·92 | 509,900 | 29·13 | 192 8 | 13,685 | ... | 189 6 |
| Total ... ... ... | 18,440 | 100· | 1,750,000 | 100· | 6 1 | | | |
| Less Products, etc., absorbed in the Creation and Maintenance of Auxiliary Instruments of Production. | | | 262,500 | 15·00 | 0 11 | | | |
| | | | 1,457,500 | 85·00 | 5 2 | 1,487,500 | ... | ... |

COMMONWEALTH OF AUSTRALIA (° 000's Omitted).

| Class. | Breadwinners. | | Income | | | Income if Pooled and Distributed on the Eisenach Programme of Equality. | | |
|---|---|---|---|---|---|---|---|---|
| Incomes: | No. ° | Per Cent. | Amount ● | Per Cent. | Per head per work. day. | Amount ° | Per Head Gain from pool. | Per Day. Loss to pool |
| | | | £ | | s. d. | £ | s. d. | s. d. |
| Under £100... ... ... ... | 1,399 | 51.86 | 102,777 | 55.45 | 4 8 | 128 960 | 1 3 | ... |
| £100 and under £125 ... ... | 102 | 5 97 | 11,545 | 6.23 | 7 3 | 9,409 | ... | 1 4 |
| £125 „ £150 ... ... | 73 | 4.30 | 10 340 | 5.58 | 9 0 | 6,774 | ... | 3 1 |
| £150 „ £200 ... ... | 46 | 2.71 | 7 528 | 4.03 | 10 4 | 4,269 | ... | 4 5 |
| £200 „ £400 ... ... | 69 | 4 01 | 18 270 | 9.85 | 17 0 | 6 316 | ... | 11 1 |
| £400 and over ... ... ... | 20 | 1.15 | 34 880 | 18.82 | 113 3 | 1,811 | ... | 107 4 |
| Total ... ... ... | 1,709 | 100. | 185.340 | 100 00 | 6 11 | ... | | |
| ● Less creation and Maintenance of Auxiliary Instruments Production. | ... | ... | 27 861 | 15 00 | 1 0 | ... | | |
| | 1,709 | 100 | 157 539 | 85.00 | 5 11 | 157,539 | ... | ... |

THE

# PROCEEDINGS

OF THE

# ROYAL SOCIETY

OF

# TASMANIA.

(1906-1907,)

Patron:

His Majesty the King.

Hobart:
PRINTED BY DAVIES BROTHERS LIMITED, MACQUARIE STREET.
1908.

# *Royal Society of Tasmania.*

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**HIS EXCELLENCY THE GOVERNOR.**

**Members of Council Royal Society in order of seniority:**

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1863—Mr. T. STEPHENS, M.A., F.G.S. *

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1878—Mr. RUSSELL YOUNG.

1886—Mr. R. M. JOHNSTON, I.S.O, F.L.S. *

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**Order of Retirement from Council**

Messrs. G. E. MOORE, T. STEPHENS, BERNARD SHAW, and GREGORY SPROTT, 1908.

" Col. LEGGE, Dr. MERCER, Dr. BUTLER, an Dr. ELKINGTON, 1909.

" A. G. WEBSTER, RUSSELL YOUNG, Sir ELLIOTT LEWIS, and R. M. JOHNSTON, 1910.

(Eligible for Re-election.)

# Royal Society of Tasmania,

## Hobart, Tasmania.

*Those persons who are inclined to benefit the Society by legacies are recommended to adopt the following*

## ***Form of Bequest.***

I give and bequeath unto the "Royal Society of Tasmania" the sum of £ such legacy to be paid out of such part of my personal estate not specifically bequeathed as the law permits to be appropriated by will to such a purpose.

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WOLFHAGEN, Dr. J. E.
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YOUNG, RUSSELL

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# Royal Society of Tasmania.

## ABSTRACT OF PROCEEDINGS.

### MAY 8th, 1906.

first meeting of the present session e Royal Society of Tasmania was in the society's rooms on May 8 presence of a large and fashionable nce. Among those present were His lency and Lady Edeline Strickland, eorge Browne, I.S.O., Private Secre- Lady Chelmsford, Sir Elliott and Lewis, the Premier and Mrs. Evans, ayor and Mrs. Crisp, Colonel and Mackenzie, the members of the il of the Royal Society—Messrs. A. ebster (chairman), R. M. Johnston, Bernard Shaw, I.S.O., Russell g, G. E. Moore, M.H.A., Hon. Dr. Butler, M.L.C., Professor Neil M.A., Colonel W. V. Legge, R.A.— W. H. Burgess, N. Ewing, C. E. s, M.L.C., Mrs. Davies, Miss Marie s, Senator Dobson, Dr. Gerard Mr. P. S. Seager, Professors Mc- ll and Ritz, etc., etc.

Secretary (Mr. Alex. Morton) pre- His Excellency with a handsomely volume of the proceedings of the Society, and read apologies for non- lance from the Venerable Arch- Murphy (written in a beautifully and legible hand), and Mr. T. ens, M.A., F.G.S., one of the vice- lents of the society.

F. A. Rodway and R. D. Campbell, Mr. P. Lockwood, were then elected ers of the Royal Society.

ile the ballot was proceeding, the ary drew attention to a fine water- painting which had just been re- from New Zealand, of the Notornis stetteri, the Takahe of the Maori. the secretary explained, was the of existing New Zealand birds, and onsidered to be extinct until the re of a specimen in 1898, of which vas a drawing. The first living bird aught in 1847 in Dusky Bay. Soon a second was obtained in Thompson Both were now in the British m. A third was captured near Lake nau, and was now in the Dresden m. The bird was flightless, and its st ally was the Pakeko (Porphyrio otus).

Excellency then delivered the fol- presidential address:—

"SOME DEVELOPMENTS IN 1905-6 CONDUCIVE TO TASMANIAN PROGRESS."

Mr. Vice-president, Ladies, and Gentlemen,—It devolves on me, as president of the Royal Society, to open the proceedings of a new session with an address of a scientific character, and I propose, on this occasion, to bring to your notice a few of the discoveries and developments of the year 1905-1906, which have some bearing on the future progress of Tasmania. The beginning of 1905 witnessed a continuing rise in the price of tin, copper, and other metals, which was then full of hope; few, however, expected that the increase would continue, and that exceptionally high prices should be sustained for so long a period. Believing, as I do, that the progress of Tasmania in the near future is closely connected with mining, the causes of the high price of copper and tin invite inquiry. It should be noted that these prices are given in terms of gold, and as the supply of gold from South Africa and other sources has been rapidly increasing, it would appear that, to some extent, the exchange value of gold has depreciated, rather than that the prices of copper and tin have appreciated. This circumstance modifies, to some extent, all other explanations. Nevertheless, the explanation which is commonly accepted to account for the high price of copper, is the rapid development of electric tramways, telegraphs, and other industrial undertakings, for which copper is still without a rival. This industrial development no doubt exists, and is likely to continue for some years at a rapid rate, but it is not sufficient to account for the upward movement of price. It is stated that China has been issuing a new copper currency which has absorbed no less than 60,000 tons of copper in the period under review. Silver blocks called "shoes" change hands by weight in China, and it is, therefore, probable that a considerable amount of the copper coinage will every year be dealt with as metal, and worked up into trinkets and articles of domestic use, thus adding to the permanent demand for copper. Nevertheless, the balance of evidence appears to show that the demand for copper has been exceptional, and it can hardly be hoped that its price will continue quite as high as it is at present. With regard to tin, the increase in price has been more remarkable, and there are strong reasons to hope that the increase has come to stay. This is a subject of the greatest importance to Tasmania; it calls for a careful analysis by experts, rather than the passing attention that it is here possible to bestow upon it. The physical properties of tin are remarkable. Its intrinsic value is great on its own merits, which is more than can be said for silver. Tin, as an alloy with copper to produce gun metal, and tin for soldering, has to be purchased, practically regardless of price, as there is no available substitute. With reference to the remarkable properties of tin when alloyed with copper, experiments have recently been made in which these metals have been combined in varying proportions to re-discover the truth or otherwise of the tradition that the bronze tools of the ancients could cut stone as readily as steel, with the result that alloys have been produced from tin and copper which are as hard as steel. They are, however, very brittle, and too expensive to be commercially useful. The greatest demand for tin is for the coating of thin steel plates so largely used for enclosing preserved foods, jams, etc. Although the present high price of tin has brought about the establishment of works for saving the tin from scrap and from old pans and other receptacles, this recovery is very limited, and it is obvious that much of the tin put on the market gets dissipated and lost for ever. Tin, therefore, differs from other metals in the extent to which it is worked up again to keep up the supply of the world. Tasmania is fortunate in having large deposits of tin, both in the original rock matrix and in alluvial deposits. The methods of recovering tin at small cost have been wonderfully developed. Hydraulic dredging has now been brought to such a stage of perfection that tin-mining in Tasmania, at present prices, must go up by leaps and bounds, and continue for generations. One of the reasons given to account for greater supplies of tin not being forthcoming from the Straits is that the supply of Chinese and similar labour is not as easily procured as formerly. It is said that the mortality exceeds 50 per cent. when it is attempted to open up bush land in Banca and Billiton, similar in character to the land heretofore productive of tin. With reference to gold-mining, the erection by the Tasmania Gold-mining Company of two sets of pumping plant equal to the largest in the world deserves special mention. This plant will make it possible to follow the reef of the Tasmania mine to a depth of probably 2,000ft. Although improvements in detail have been effected in the methods hitherto known for extracting metals, no new process of importance appears to have been discovered in 1905-6. The West Coast of Tasmania is reaping great benefits from the operation of smelters under a system in which the sulphur in low-grade ores is made to act as fuel to facilitate their reduction. By the adoption of this system on a large commercial scale, vast quantities of low-grade ore, too poor to pay for transport outside Tasmania, can now produce rich returns. It is reported in America that by very high temperatures obtained electrically, gold, copper, and silver have been distilled; that is to say, boiled off in vapour, and the vapour re-condensed into liquid metal. This achievement may open a way to separate certain complex ores, which have defied all previous efforts.

The adaptation of the steam turbine for marine propulsion has made enormous strides in the last year. Tasmania is closely connected with this development, inasmuch as the steamer Loongana, built for the Tasmanian trade, was the first turbine steamer to cross the equator, and her voyage out from Glasgow to Australia, with one stop, at the high speed of 15 knots, and her subsequent performances have done more than any other achievement to silence the strong body of conservative engineers and owners of special machinery for constructing reciprocating engines, who have been proclaiming that the turbine is an experiment, and a wasteful application of coal. At low and moderate speeds, that is to say, at speeds below 14 knots the turbine at present does waste coal; but as the speed increases, the relative mechanical efficiency of the turbine increases in comparison with the efficiency of the reciprocating engine. It appears to me that this remarkable advantage of the turbine may be largely accounted for by the fact that in a turbine the back thrust of the screw propeller is nearly balanced by the forward thrust of the steam against the blades of the rotating rings, and consequently the extravagant internal friction of the reciprocating engine, which becomes enormous at high speed, is absent in a turbine-driven steamer. There has been a phenomenal development in the manufacture of gas and oil engines. This is so pronounced that factories in this line have been working day and night in England to meet their orders. Very simple appliances have been developed, by which a gas engine makes its own gas from coal or charcoal. This system has already been applied to sea-going craft; a marine gas-driven engine of 500 horse-power is under construction, and a 1,000 horse-power plant is designed. It appears that these producer-gas plants will render inestimable service to the mining industry of Tasmania wherever water is scarce, and I venture to suggest that these advantages have not received the attention which they deserve. In the railway world, the past year has been remarkable for the building in England of the largest possible engines that could be safely got through existing tunnels and stations. Speeds of 70 miles an hour have been recorded, and maintained with safety. At the opposite end of the scale comes the railway motor-car. Its advent is no longer an experiment, it solves the problem of maintaining traffic at reasonable expenditure on railways built through districts of which the passenger and goods traffic is too small to be remunerative under the present system of working. These railway motor carriages have not yet been introduced in Tasmania, where the opportunities for their employment are so evident that it may be a penny wise and pound foolish policy to delay their introduction. In the development of motors for use on common roads, it may be noted that the steam car has been defeated in the struggle for supremacy by the petrol engine. This is largely due to the great improvements in the construction of the explosion engine, and to the methods discovered to vary the speed of these engines, otherwise than by gearing.

The Panama Canal is an undertaking, prospectively, of great importance to Tasmania. The completion is very far off, and very sanguine people think it may be constructed in 12 years; nevertheless, the steps that are being taken to achieve success deserve our attention. The Government of the United States has made this canal a national enterprise. After law and order had been established in the canal zone, the American Government proceeded to exterminate the yellow fever mosquito, and to carry out other sanitary reforms which have made Panama and Colon possible places for Europeans to live and work in. In fact, it is more than probable that Panama, which has for generations had the reputation of being in the most deadly zone of the tropics, will soon become a model of sanitation, thanks to the combination of modern science and the uncompromising methods of American administration. President Roosevelt appointed a technical commission, on which he associated with the leading engineers of the United States the greatest experts the world can furnish in canal construction. This commission has recently presented its report, and, to the relief of those genuinely interested in the success of the Panama Canal, the majority reported in favour of a sea-level canal; but, if the newspapers are to be credited, the President of the United States supports strongly the recommendation of the minority, which is in favour of a canal with a series of locks. The work of excavation at the higher levels which is being done at present on the Panama Canal will be equally useful whichever project is finally adopted. A canal comprising a series of locks and lakes offers the advantage—which is, probably, only an estimated advantage—of taking shorter time to build. It also makes it easier to dispose of the flood waters of neighbouring rivers. On the other hand, a canal with locks would become useless as the result of even slight shocks of earthquake, which would cause the locks and dams to leak. When a dam, holding back a large volume of water, begins to leak the chances of the gap widening and the whole work being carried away are appalling. Well-wishers of the Panama scheme desire that it should be, as far as possible, immune, both from accident and from destruction by design, and that the canal should therefore be cut down to the sea level. The importance of this canal to the whole of Australia generally, is immense. The commercial aspect of the canal is, perhaps, but a secondary question side by side with its strategic importance. When the time comes for a struggle between the white and yellow races for the mastery of the Pacific, Anglo-Saxon America, with Anglo-Saxon allies, will be sure of victory if fleets can be concentrated by the use of the Panama Canal; those who study with earnestness the future of a white Australia should welcome every step in this great work. From the commercial point of view the Panama Canal will add to the natural advantages of Tasmania's commercial position, and by offering new markets for Tasmanian apples, and more speedy transport, this new outlet will relieve the anxiety of those who think that too many orchards are being planted—an anxiety which I do not share.

Professor Milne, the best-known authority in the world on earthquakes, has recorded the opinion that there are about thirty thousand earthquakes in the world every year. Some of these are, of course, very faint, and are only recorded on delicate instruments; but it is pleasing to note that the comparative immunity from serious earthquakes enjoyed by England is also enjoyed by Tasmania. There is little doubt that the principal cause of earthquakes is the shrinkage of the world as it gets older and colder; this causes disturbances of the crust, and there is reason to believe that the countries, such a

Tasmania, which were volcanic in a comparatively recent geological period, and then became quiescent, are nowadays the most immune from earthquake shocks.

Recent progress in the commercial utilisation of waterfalls is very remarkable. The rush to harness what is left of the Falls of Niagara has been frenzied, and the disappearance of the Falls is as well in sight as any disappearance can be. From this Tasmania may draw a useful lesson. The utilisation of the power available from the Great Lake is a topic which has been often mooted. I am inclined to think the time has come when it should receive greater attention, and when efforts should be made to attract capitalists to take it in hand. The idea should be dispelled that any big lake provides water-power as a matter of course; this is not so. There are big lakes elsewhere, like Lake Tchad and Lake Tanganyika, that are growing smaller instead of keeping their level. What provides water-power is a large catchment area at a suitable elevation in a country with a reliable and sufficient rainfall. These desiderata are present in Tasmania. We have, moreover, a climate in which a manufacturing population can thrive and work to the best advantage, and the facilities are numerous where factories could be erected in close proximity to deep-water harbours. The transmission of electricity from the centre of Tasmania to the Coast does not present insurmountable engineering difficulties, if sufficient money is forthcoming. The commercial aspect of the question is not, however, encouraging, if calculated on present demands for electrical power; but it may be noted that the same diffident view was held with reference to the first Power Supply Company established at Niagara. The proverb, "that money makes money," finds its counterpart in the fact that power brings power, by attracting people to itself, in order that it may be utilised. The local press has, within the past year, published a most interesting suggestion for working the Tasmanian railways by electricity, although it may be regretted that the scheme lacked details as to the cost of converting the rolling-stock, and gave no prominence to the fact that, while electricity is much cheaper than steam traction for a frequent train service, the use of steam is cheaper where trains are few and far between. The application of electric power for unwatering mines, such as the Tasmania mine at Beaconsfield, is not impossible, and I trust that many other mines on a par with the Tasmania will be discovered, and that they will furnish tempting propositions for electric power from the Great Lake.

With regard to telegraphy, I desire to notice a portable telephone instrument developed by a Tasmanian, and shown at the military camp at Ross on Easter Tuesday. The apparatus has the great merit of the thorough working out of detail seldom seen at the first exhibition of a new instrument. By its means any standing run of ordinary telegraph wires, or fencing wires, can be used as a connection for reliable communication for a distance equal to the breadth of this State. With regard to wireless telegraphy, I note with regret that Australia appears to be backward and apparently reluctant to face this problem with the characteristic enterprise which this young community shows in other paths of progress. Within the year under review messages have been sent by wireless telegraphy from England to Port Said, and ships crossing the Atlantic have been in constant communication with the shore, and able to issue a daily paper on board. I firmly believe that, with the use of wireless telegraphy, messages could be sent to England at a shilling a word, and that the cheapening of telegraph rates would be an inestimable boon to Australia. The rate of transmission of wireless telegraphy has been increased from fifteen to thirty words a minute over moderate distances. Type-setting by telegraphy has reached the stage of commercial development, but I hope the time is far distant when our Tasmanian newspapers will be set up in type to one same order by an operator sitting in a bush capital. In electric lighting, Japan, a country very like Tasmania in its physical features, has made such progress as to light cheaply, not only its important towns, but also its villages, by electricity. In this line of enterprise Launceston has set an example to Australia, which would do credit to any city in the world. It behoves other centres of population in Tasmania to follow this good example. The use of electricity in the manufacture of steel has been developed to the extent that it is now commercially remunerative where electrical energy is available at the price of £10 per horse-power. This calls for attention, because in Tasmania we have abundance of good iron ore, and a reasonable hope that an electrical horsepower could be obtained at a figure far below £10. I may be allowed on this occasion to repeat my congratulations on the completion of the Denison Canal and of the Stanley breakwater, which I also had the pleasure to open within the last year. These works draw attention to the growth in the size and depth of modern steamers. These are increasing with marvellous rapidity, a rapidity which is alarming to most harbour trusts, but enables us to rejoice in the fact that Hobart offers, and will offer, apparently, for endless ages, deep water berths unrivalled in the rest of Australia. The necessity by which harbour authorities all over the world are being pushed to provide wharfage for large draught steamers will, undoubtedly, increase the demand for heavy piles, such as were supplied from Tasmania for the Dover harbour works. Trade in these piles is worth studying, by looking for orders wherever a large new harbour is projected. It is easier for Tasmania to hear that a new harbour is projected than for the contractors to know how easy it is to procure in Tasmania piles of extraordinary length, strength, and specific gravity.

In shipbuilding an effort is being made to regain for the English mercantile marine the primacy as regards speed which now belongs to Germany, and considerable progress has been made in the building of two great steamers for the Cunard line, which will be 785ft. in length, and with a guaranteed speed of 24½ knots. There is reason to hope the guaranteed speed of these gigantic turbine steamers will be substantially exceeded. For the first time in history the number of steamers on the English register surpasses the number of sailing ships. The conclusion of the war between Russia and Japan has taught many lessons in the art of war. The Defence Forces of Tasmania have already adopted in details of tactics, uniform, and entrenchments some of these lessons. The war in the East has thrown light on many scientific problems of general interest. On land, prominence was given to the importance of railways in any scheme of defence, and it appears that a country not likely to be attacked for a long time might well spend money intended for future defence on strategical railways, having at the same time a commercial value. On the sea the modern design of battleship was tested in practice. It was shown that larger ships are required to keep the sea efficiently, to carry many long range guns, and to have a margin of stability after being hit by a torpedo. These lessons have rendered the greater part of the navies of the world obsolete. It was also shown that a large fleet is worthless unless it is kept in the highest state of repair, that no guns, explosives, or "materiel" is worth having which is not the very best, and that enormous dockyard resources, with skilled workers in constant employment, must be at hand to any fleet worth having. The importance of the torpedo-boat has been greatly discounted; these craft did not save Port Arthur, or sink a single Japanese warship. It appears that ships struck by Japanese torpedoes were repaired by the Russians, and brought back into the fighting line, and that the effect of the blow of a torpedo is purely local on the structure of a ship. It was shown that life on torpedo-boats and destroyers is so hard that a large sea-going fleet in constant training is necessary from which to recruit crews physically able to keep the sea in torpedo-destroyers, and to fight such craft at night and in bad weather. Crews unaccustomed to fight in uncomfortable weather were shown to be at the mercy of an enemy accustomed to the sea. The advantage of superior speed was shown to give choice as to the place where decisive actions are to be fought by battle fleets. The designs have been published of a turbine-driven torpedo, with a speed of thirty-five knots. The British Admiralty are projecting 20-knot submarine boats. No more powerful means for harbour defence has yet been devised. The salvage operations of the Japanese, by which they raised from the deep several battleships and cruisers are amongst the most instructive lessons of the war. It appears that there are no specially equipped salvage steamers stationed in Australian waters, although the volume of shipping is great and increasing. The success of Japan in raising a whole squadron of wrecked shipping may be an incentive to establish salvage companies in these waters. Hobart would be an inviting centre for such an enterprise, in view of our magnificent harbour, and its convenient position between Australia and New Zealand. The inclination to sell their navies—comprising several powerful ships of recent date—on the part of the South American Republic, tends to prove the proposition that all second-class navies are not worth maintaining. Notwithstanding the futility of its mismanagement, the concentration of a Russian fleet in the Sea of Japan, at a distance from its base in Russia of more than half the circumference of the world, has put an end to the theory that distance is any protection from naval attack. The supremacy of the sea now belongs to the nation that can build fastest, and has the greatest number of building slips and yards for vessels of the largest size. On this ship-building standard the supremacy of England is undeniable, and it does not appear that it can be seriously challenged for half a generation.

In scanning the political horizon for facts that can be dressed in a scientific garb, a prominent place is due to the visit of General Booth to Tasmania, which has drawn attention to the Imperial aspects of the emigration question. With masterly ability, and with an organisation suited to the needs of the multitude, General Booth has made the Salvation Army the greatest and most scientific emigration organisation for receiving emigrants at the end of their journey that the world has seen. The entente cordiale between England and France in politics has developed the entente municipale and the interchange of hospitalities on a vast scale between parliamentary and municipal representatives of English and French politics, and interchange of visits by large parties of workers crossing political borders has established the germs of an international procedure, from which some hope may be drawn for an era of universal peace, and for some movement towards the general reduction of armaments. It has been realised in England as well as here that single member constituencies produce startling anomalies, and a very disproportionate representation of the will of the people. Theoretically, no greater service could be rendered to the democracy than by devising and enacting a satisfactory system of proportional representation. Tasmania has in the past been foremost in giving an example in this line of progress, and the question is one which may again deserve attention on scientific grounds. The proposal to build a railway to the summit of Mount Wellington is a step in the policy of advertising Tasmania and its peerless climate, which my Ministers have as closely to heart as I have myself, and the Tasmanian Tourist Association may be congratulated in the application of science in its methods. In conclusion, I venture to hope that this Royal Society of Tasmania may, in the session now opened, contribute its share of work, in its special sphere, towards the advancement of the progress of this community.

Mr. R. M. Johnston, I.S.O., F.S.S., said it was generally supposed that the Royal Society was limited to the consideration of topics dealing with natural history, and he had often been reproached with having introduced questions of an economic character, which were regarded as outside the society's work; but he thought that the varied interests of man were as much entitled to their serious consideration as the vagaries of a bacillus, and he was glad, therefore, that His Excellency had drawn attention in his address to a number of matters which affected Tasmania in many direct and indirect ways. In considering the question of price of tin, to which His Excellency had referred in his opening remarks, they must remember that that was determined by the cost of production at the worst advantage. He was glad to say that there was a prospect of the poorer tin fields, which were of such vast extent in Tasmania, being made profitable, from which great benefit would result to the State. His Excellency had referred to the great progress that had been made in various ways. This led him to think of the tremendous progress that had been made by England during the past century, at the end of which she had a population of 42,000,000, far better clothed and fed than when the population was very much smaller. This was the result of the great discoveries that had been made, which had annihilated distance and time, and brought the producers and the consumers closer together.

Senator Dobson then moved a hearty vote of thanks to His Excellency for his interesting address. Whenever His Excellency addressed them they could not but realise what an intelligent interest he took in all that affected the well-being of the island. His Excellency had shown them how very many important affairs going on in the world affected Tasmania, either directly or indirectly. He quite agreed with what His Excellency had said as to the necessity of having the very latest ships for their naval defence. He was glad His Excellency did not share the pessimistic views as to there being a slump in the fruit market. He (Senator Dobson) had been pessimistic once, but was so no longer. No industry here had succeeded so well as the fruit industry, and though the other States were vieing with us, we should remember it was Tasmania who pioneered the market, and showed that apples could be transported from one end of the world to the other. He had always thought that England was first as a builder of ships, but he had recently seen an article showing that Germany was on a par with us, both as to the speed and size of the ships she built, and as to the perfect mechanism of the machinery. He was glad that His Excellency had referred to the projected aerial railway to Mount Wellington. He believed that it would be a great success, that it would attract tourists from all parts of Australia, and that it would prove to be an advertisement worthy of our Yankee cousins.

The vote of thanks was carried by acclamation, after which those present were entertained in the trophy-room by the members of the Lady Hamilton Literary Society, and a very enjoyable half-hour was spent.

## JUNE 12th, 1906.

The monthly meeting of the Royal Society of Tasmania was held at the Tasmanian Museum on Tuesday, June 12, 1906. His Excellency Sir Gerald Strickland who was accompanied by Lady Edeline Strickland, and accompanied by Mr. Geo. Browne, I.S.O., presided, and the Chief Justice, Sir John Dodds, K.C.M.G., was among those present. Apologies for absence were received from the Bishop of Tasmania, Colonel Legge, and Sir Elliott Lewis.

Mr. J. W. Tarleton was elected a member of the society.

### Biological Ancestry of Human Diseases.

Dr. Gerard Smith read a highly technical paper entitled "The Biological Ancestry of Some Human Diseases." He said that they had no doubt heard of a recent cryptic utterance made by Sir Frederick Treeves, which was an expression of the new school of medical thought, Sir Frederick Treeves had said that "if there were no diseases, the human race could not exist." That was a statement which, although it embodied a truthful philosophy in respect to our mental attitude with respect to the reasons and causation of disease, yet it went too far for our present comprehension. He (Dr. Smith) wished to present a lesser theory, taking in a certain limited class of bodily disorders. It was that disease in man was healthy life misplaced. Diseases were not rightly termed abnormal, but normal, processes going on under conditions which had changed, and constituted diseases only because the organism in which they occur is in an incompletely developed state, and in a condition of instability and change. Proceeding, Dr. Smith laid it down that the last organs to develop in the order of evolution were the first to fail, whether by disease or advancing age, or, in other words, that physiological recency meant pathological weakness. It would be expected that an organ which had been among the earliest developed would be less likely to be unstable. The longer an organ had performed its functions in an adequate and satisfactory manner, and had therefore attained by survival of a high standard of perfection, the less likely would it be to fail in its function. In spite of ill-treatment, the stomach, one of the earliest developed organs, was the least liable to disease; whereas the lungs, heart, etc., which were of more recent development, were more liable to disease. This, he considered, was in harmony with his theory, the organs being as it were in a state of transition or instability, with the result that normal processes would go on under conditions no longer favourable. By throwing back to an earlier stage of their evolution cells would be put out of harmony with their surroundings, so to speak, and thus cause disease.

### Democracy and Socialism.

Mr. E. C. Nowell read a lengthy paper, in the course of which he attempted to give definitions of democracy and socialism. He described the Athenian polity, showing that in the ancient democracy the whole people exercised direct control of the affairs of the State, both legislative and executive. No such system existed nowadays, except in Switzerland. There was, with the exception mentioned, no modern democracy in the exact sense of the term. Mr. Nowell next dealt with socialism, quoting largely from Professor Flint's standard work on the subject, and also from the works of other British and European writers. According to Professor Flint, socialism sought to re-construct and reorganise the whole social system, and to effect a vast improvement in every department of human life. It aimed especially at a thorough reorganisation of industry and property, at such an alteration of the conditions and arrangements as to the production, distribution, and enjoyment of wealth as would abolish poverty and remove the discontent of the operative classes.

Mr. Nowell also dwelt on the various types of socialism which have been developed—at least in theory—communism, collectivism, co-operation, and State socialism, etc. He concluded by giving a summary of the arguments advanced by American writers in favour of socialism, and quoted an interesting extract from a recent article by Mr. Upton Sinclair, which showed how the perfection of machinery had reduced the amount of human labour requisite to produce articles most extensively consumed.

Mr. E. D. Dobbie, who opened the discussion on Mr. Nowell's paper, saw no objection to the use of the word democracy as applied to modern States. It was true that it had lost in a measure its original significance, as used in reference to the Greek States, but its application with a modified significance to modern States was quite legitimate and perfectly intelligible. The people no longer exercised direct control over the affairs of the State, but they were none the less the repository of political power. The great feature which distinguished modern from ancient democracy was the system of representation. Indeed, without the representative system modern democracy would be impossible, on account of the size of the States. Socialism, he considered, was an unmistakable protest against the present system, and indicated plainly that there was need for some reform of existing institutions. A contest was approaching between socialism on the one hand and individualism on the other, and he thought that the result would be a compromise, preserving the moderate forms of both. In his opinion, there was no probability that individual production, private ownership of land, would ever be abolished. The present system had its undoubted merits, one of the greatest being the incentive which it gave to individual effort. If that incentive were lost, civilisation would be endangered.

Mr. R. M. Johnston endorsed Mr. Dobbie's remarks. There were two extremes—unrestrained individualism on the one side, and complete socialistic rule on the other. He believed, with Mr. Dobbie, that society would take the middle course.

### Preserving Timber.

Mr. R. M. Johnston called attention of members of the society to the process patented by Captain E. T. McFie for preserving timber, and suggested that a series of tests should be made in order to ascertain its merits.

Mr. K. C. Richardson said that the tendency of Tasmanian timbers to split was a bar to their introduction into foreign markets. If any method could be discovered of preventing wind shakes, a great expansion of the timber industry could be looked for. The eucalyptus was, in a sense, an evergreen; the sap was always in the stem. Consequently when the tree was cut down and sawn into billets, rapid shrinkage took place, and as the process was more rapid at the ends of the logs, splitting was almost inevitable. What they wanted was a paint which should prevent this, and cause the process of seasoning to proceed uniformly through the piece of timber. He had used several paints for that purpose, but none, so far as he could judge, were equal to Captain McFie's. He would make some tests shortly, when he shipped a small consignment of timber to England, and in due course would communicate the results to the society.

In moving a vote of thanks to the gentlemen who had read papers, His Excellency made some reference to socialism. Something of the character of a socialistic state existed in the religious orders and the guilds of the Middle Ages. In the religious orders property was held in common, and tasks were assigned to the members suited to their several capacities. When their religious enthusiasm effervesced, however, they grew lazy, and for the want of some authority to enforce discipline and compel the members to work, the organisation collapsed. That suggested a difficulty which was the crux of the whole question: How were they to ensure industrious application to work in the socialistic state, and how were they to assign proper tasks to proper persons? And, again, who was to see that those duties were properly performed? So far the State had merely touched the fringe of production. Agriculture, the most important industry, was wholly in the hands of private individuals. He did not know whether in the socialistic State inspectors would be appointed to see that the farmer put the right cow in the right paddock; but supervision and discipline of some sort would be essential.

The vote of thanks was carried by acclamation, and the meeting terminated.

## JULY 11th, 1906.

ıe monthly meeting of the Royal So-
; was held on July 11, His Excellency
Governor (who was accompanied by
r Edeline Strickland and Mr. Geo
wne, Private Secretary) in the chair.

### School Hygiene.

·. Elkington, Chief Health Officer,
a most interesting and important
ess on "School Hygiene," illustrated
diagrams, the lantern-slides showing
different ways in which children sit
chool, getting into bad habits, spoil-
their eyesight, curving their spines,
doing themselves all sorts of injuries,
h were owing to bad ventilation,
y constructed schoolrooms, badly
ed windows, and wrongly constructed
s. All these could be obviated if
ols were properly built, and modern
iances used, specimens of which were
wn on the screen. The greatest of
faults committed in the name of
ation in the past, said Dr. Elking-
had been the non-recognition of the
ical side of the child's environment,
her as an all-controlling factor in
development of the spiritual side, or
n all-important influence upon the
l's future. This was not fair to the
l, since it interfered with his mental
pment for the struggle of modern
petition, and frequently saddled him
a lasting physical defect. It was
ıer reasonable nor fair to anybody
ontinue attempting to force impres-
, through eyes which were prevented
seeing and ears which could not
erly hear, to reach brains somnolent
unresponsive from carbonic acid
ning. In London, great efforts were
g put forth to better the physical
moral status of the County Council
l population, and the results amply
fied the cost. Throughout the British
the work was going on apace. Ger-
r had for years appreciated its value,
the result that the proverbially be-
acled student of a generation ago
becoming rarer. Switzerland had a
ly organised system of examination
inspection, practically dominated by
chool medical officer, who was a sort
gienic autocrat. Many of the Ameri-
States placed the hygiene of their
ls directly under the State health
ority, and Japan had an exhaustive
m of medical inspection and super-
n by some 8,424 specially appointed
rs. So much does America value
ne that it is the only compulsory
ct in the school curriculum in a
er of the States. It was well for the
ers to become acquainted with the
principles governing site, struc-
circulation, planning, lighting, and
ıpply; but from a practical point of
these were of less importance than the knowledge of how to utilise to the best advantage what was provided. For those who could afford to erect a private school on correct lines, there was a large available literature in several European languages, and even in Japanese. When money was to be spent on school buildings, it was generally better to expend it on the inside than on the outside. Mechanical ventilation or adjustable desks would be a more important innovation than a bell tower. School hygiene did not necessarily imply large expense, nor could a system be run on formal cut and dried lines, suitable for all latitudes and all classes of schools. Like Opie's colours, it required to be mixed with brains. Its resources were available for the smallest of back-black schools in Canada or Australia, and were essential for the largest of the great establishments of London or New York. School hygiene was not intended solely for the child. The teacher was the mainspring of the school, and causes which operated adversely upon his or her physical condition, tended to interfere with educational result. School hygiene was not a question for State educational systems alone. Its importance was as great in private as in public schools, and its economic results were equally striking in both. As a rule, physical culture should be regulated by a medical man, as serious damage might be done to individual weakly children by physical overstrain. In the absence of a trained instructor, it should never be undertaken. Ordinary healthy children derived more benefit from a noisy scamper round the playground than they would get from a half-hour's ordeal of club-waving or toe-touching mechanically directed by an uninterested and unskilled teacher. After dealing with the benefit to be derived from the medical inspection of schools, Dr. Elkington concluded by describing the different mechanical appliances, such as windows, school desks, warming apparatus, etc., used in modern schools, which were thrown on the canvas by Mr. Nat. Oldham.

A discussion followed the paper, in the course of which Mr. Smith, headmaster of the Model School at Battery Point, spoke of the splendid work done by Dr. Elkington in improving the conditions of the schools in Tasmania; efforts which were very much appreciated by the teachers throughout the State.

Bishop Mercer said if the Government compelled children to go to school they must make the schools healthy places for the children to work in, no matter what the cost. Many of the schools in the country were old-fashioned to a degree. The teachers suffered even more than the children by bad conditions.

Mr. Oldham said it was not State-schools only, but private schools, that wanted looking after.

The Chairman said he could not adequately express the very high appreciation which Dr. Elkington deserved for his efforts in popularising a really sound system of school hygiene. Nowhere had he seen the work done so systematically and so thoroughly as here.

### Notes on King Island.

A paper, entitled "Notes on King Island, and Recent Discoveries," prepared by Messrs. R. M. Johnston, I.S.O., and Alex. Morton, was read, from which it appeared that within the last few months several interesting specimens of animal bones had been discovered at King Island by Mr. J. McKie Bowling in a sand dune at Surprise Bay. Mr. H. H. Scott, curator of the Victoria Museum, Launceston, considered they were the bones of an extinct emu, and other remains. Arrangements were accordingly made, with the approval of Mr. A. G. Webster, chairman of trustees of the Museum, for a visit to the spot by Mr. Alex. Morton, accompanied by Mr. R. M. Johnston, to whom the necessary leave of absence was granted by the Premier. Messrs. Morton and Johnston obtained a number of bones, of which they found an immense quantity huddled together, representing a great range of species, in the sand-dunes. Among the animals represented were wallaby, wombat, emu, marsupial rats, a number of skulls of a carnivorous marsupial closely allied to the Tasmanian devil, and the fossilised metatarsus of the emu. It was highly desirable that those dunes should be still further examined, so that not only the Tasmanian Museum, but other Museums throughout the world should contain specimens of this extinct species. The birds were very similar to those found in Tasmania, while one or two Victorian species seemed to have established themselves, such as the Gang-gang Parrot. Particularly noticeable was the number of black magpies, or jays (Strepera fulignosa). Among others were musk duck (Biziara lobata), the blue heron (Herodias pacifica), the black duck (Anas superciliosa), Jameson's gull (Larus Jamesonii), Pacific gull (Larus pacificas), the scoty oyster-catcher (Himanthropus fuliginosus), and many others, which gorged themselves on the vermin cast up in the kelp which strewed the shore. Three snakes similar to those found in Tasmania were common—the tiger, the diamond, and the whip snake. Two or three species of lizards and several frogs were found, as also six specimens of beetles, and seven or eight species of land and freshwater shells. In the early part of last century the island was a favourite resort of sealers, the seals being indiscriminately slaughtered, but that had recently been stopped by the Fisheries Commission, with the result that seals once more abounded. Very excellent blackwood grew on the island, large quantities being shipped to Melbourne and Launceston. They recommended the reservation of a large area as a timber reserve. The dairying industry promised to become a very important one, but better communication was required with the mainland. If the Marconi system of wireless telegraphy could be installed connecting the island with Victoria and Tasmania, they were convinced it would soon repay the initial outlay, and materially help to increase the population and prosperity of the island.

A paper on the "Geology of King Island" was read by Mr. R. M. Johnston, and illustrations of the scenery were depicted by means of lantern slides.

A vote of thanks to Dr. Elkington, and Messrs. Morton and Johnston terminated the proceedings.

## AUGUST 15th, 1906.

ordinary monthly meeting of the
Society was held in the Society's
at the Museum on August 15. His
ency the Governor, who was accom-
l by Mr. Geo. Browne, I.S.O., Pri-
!ecretary, presided.
following new members were elect-
Hon. N. K. Ewing, Mr. J. A. John-
I.A. (principal of the Training Col-
Mr. H. J. Spencer (electrical
er), and Dr. F. W. Noetling, Ph.D.,
ıas for many years been connected
the Palæontological section of the
ı Survey Department, and has con-
ed numerous articles to various
ations on palæontological and other
ts.

### The Tasmanian Emu.

nel W. V. Legge's paper on the
nia Emu (species Dromiaus) was
in the Colonel's absence, by the
ary (Mr. Alex. Morton). "In con-
a with the interesting discovery of
bones on King Island some little
since," wrote the colonel, "and the
trip of the Director of the Museum
site of their exhumation, a few
ks about the Tasmanian species
e opportune. I had the pleasure
pecting the bones, in company with
forton, and was struck with the
size of the femur, which would re-
t a bird a little more than half
ze of D. novæ hollandiæ, and the
sion came to my mind that the
might not improbably belong to
ıaller insular form, the Black Emu
er), of Kangaroo Island, S.A. This
existed there in the beginning of
t century, and specimens were cap-
and sent to Paris by Peron. The
as afterwards exterminated by the
s, much in the same way that the
n Tasmania was—chiefly by being
wn and caught by dogs. It is
able to suppose that D. ater ex-
its distribution to King Island,
in fact, the insular form of the
ental species." The paper concluded
suggestion that some of the King
bones should be sent to the Flor-
Museum for a comparison by the
or with the skeleton of D. ater
was there.

### The Cucumber Herring.

per by Mr. C. H. Harrison, assist-
retary of the Northern Tasmanian
es Board, was read by Mr. R. M.
on, I.S.O. It was entitled "Some
n the propagation of the cucumber
g from the captive fish." Mr.
on, who has taken a great deal of
t in this branch of science, was successful in hatching a large number of eggs of this interesting herring, which was at one time plentiful in our Southern waters, though for some years they have been extinct. The result of the experiment at the Waverley ponds in Launceston clearly demonstrates that this fish, like the salmonidæ, can be dealt with, and it is to be hoped that not only the Northern, but the Southern and other rivers will be stocked.

### Aboriginal Stone Axes.

A paper on a recent discovery of some Tasmanian aboriginal stone axes on Tasman Island by Mr. J. E. Philp was read by the Secretary (Mr. Alex. Morton). On a recent visit to Tasman Island, Mr. Philp found, near the summit, a large number of chipped stone implements, clearly showing that at one period the now extinct aboriginals of Tasmania visited Tasman Island, whether in search of mutton bird or crayfish it is difficult to say; but they must have made use of their very rude canoes, known to have been used by them on the East Coast, to go from the mainland to the adjacent island. It would be interesting to follow this matter up, and see if any shell middens, as found on the mainland, exist on Tasman Island. Professor Edward Tylor, F.R.S.., of London, in a very interesting paper published in 1893, entitled "On the Tasmanians as Representatives of Palæolithic Man," wrote:—"The Tasmanians up to the time of the British colonisation in the present century habitually used stone implements shaped and edged by chipping, not ground or polished. These belong, notwithstanding their modern date, to the order of the very ancient palæolithic implements of the Drift and Cave periods, from which the later implements of the neolithic order are distinguished by greater form and skill of finish, and especially by the presence of grinding or polishing. The comparison of the Tasmanian stone implements," wrote Professor Tylor, "with those of the ancient world impresses on us the fact that the rude modern savage was content to use a few forms of implements for all purposes of cutting, chopping, etc., these being flakes as struck off the stone, and such flakes, or even chance fragments, trimmed and brought to a cutting edge by striking off chips along the edge of one surface only, whether completely or partly round. Such stones are known to the Stone Age of the old world. The Tasmanian, though using types of implement not unfamiliar to palæolithic man, is not known to have attained to making any implement approaching the characteristic palæolithic pick, chipped into symmetrical form, and edged and pointed by chips taken in order from both surfaces. If," says Dr. Tylor, "it may be taken that the information from Tasmania is conclusive in this respect, it will appear that the savages there, within this century so miserably erased from the catalogue of the human race, were representatives of Stone Age development, a stage lower than that of the Quarternary period."

At the request of the secretary, Dr. Noetling, who is an authority on the Stone Age, spoke on the subject, and said he had been greatly struck with the likeness of the Tasmanian stone (specimens of which were shown in a case) to the eolithes of Europe, which were of artificial origin, and were shaped between 50,000 and 100,000 years ago, when our European ancestors were in about the same state of cultivation as the Tasmanian aboriginals were. He agreed with Dr. Tylor that the latter were in the same state as the palæolithic men of Europe.

### Schouten Peninsula.

The most interesting item of the evening was a lecture by Mr. J. W. Beattie, beautifully illustrated with 50 specially-prepared lantern slides, on "Schouten Peninsula: its adaptabilities as a natural reserve for the protection of the native flora and fauna of Tasmania." Mr. Beattie's suggestion that this place should be reserved as a sort of national-park has been dealt with by the society on several occasions. At the June meeting in 1904 Mr. J. F. Mather read a very interesting paper on this subject, and the proposal last night met with the warm approval of the society. The views embraced the whole of the coast line from Denison Canal to Freycinet Peninsula, and gave a very realistic idea of what sort of a place the proposed reserve is. Mr. Nat Oldham managed the lantern with his usual skill.

Mr. Morton said that Tasmania was the only State which had not a reserve for the preservation of the fauna and flora. It was high time that some steps should be taken to acquire one, and none better could be found than the one proposed.

After a short discussion on the paper, a cordial vote of thanks was passed to the speakers, on the motion of the chairman, after which the proceedings terminated.

## SEPTEMBER 11th, 1906.

### THE NEW EDUCATION.

One of the most interesting subjects discussed at the Royal Society for some time past was that of "The New Education," on which Mr. J. A. Johnson, M.A., Principal of the Training College, read a paper at the meeting on September 11. There was a fairly large attendance, among those present being His Excellency the Governor (who presided), and Lady Edeline Strickland, accompanied by Mr. Geo. Browne, I.S.O., Private Secretary; the Minister of Education (Hon. W. B. Propsting, M.L.C.), Bishop Delany, Messrs. R. M. Johnston, I.S.O., G. E. Moore, M.H.A.

Mr. J. A. Johnson, M.A., who was received with applause, said

In addressing the Royal Society of Tasmania on education I am well aware that, while the subject must be of vast interest to all the members, many of the technicalities of the art and science of teaching which I shall touch upon will appeal only to those actively engaged in the work of teaching. Still, any aspect of this subject must find a response in the minds of all those who have the well-being of the State at heart; and, therefore, I feel no hesitation in addressing you on the subject in which I am myself most intensely interested, and to which all of you must have given much time and earnest thought.

The first thing to be said about the term "new education" is that the views current in the present day in regard to education are not new, but old—old as Plato; new in the sense, perhaps, that the world's thought about the meaning and scope of education is being cast in the mould of these later days, and shaped again to new issues and fairer ideals. The history of education is the record of a series of failures; the next generation will quietly brush aside the dust raised by the complacent reformers of to-day. But need we be discouraged when we view the small results of past effort as they appear, magnified by the powerful lenses of time and space? No; let us rejoice, rather, that our little systems have their day, and then cease to be—for the words of the poet about one good custom corrupting the world are especially true when applied to the f the educator. Co
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education during the last fifty years, we have much cause for congratulation and encouragement. The time is slowly passing away when the reproach can be brought against us, as a race, that whilst skilled men are required to train our horses it is a matter of no consequence to inquire into the qualifications of the person appointed to educate our children. States are beginning to recognise that the teacher who works on mind is as responsible a person in the Commonwealth as the physician who ministers to the body; and that no unlicensed practitioner should be allowed in the one sphere any more than quacks in the other. Departments are now less departmental, and more educational; teachers are no longer pedagogical machines, but are becoming more and more members of a learned profession, with the power of initiation and adaptability. The atmosphere of the school is tending gradually to conformity with that of a well-ordered home. The ascent of the ladder of knowledge is as difficult as of old; but there is a change in the method of reaching the top. In the past, the pupil was urged on from below—with the aid of a birch rod; now the master beckons him upwards, and the prospect towards which his eyes are directed is so serene and beatific that he feels it glorious to ascend. The teacher is viewed, not as a stern taskmaster, but as an elder brother, who is helping materially to create the best conditions for the realisation of the possibilities of life.

Contrast these ideals of primary education with those that have held sway within the memory of the present generation. In Britain, fifty years ago, a commission was appointed to inquire into the state of primary education, then in the hands, mostly, of private teachers. The report disclosed a most discreditable state of things to all concerned. The teachers were not only untrained, but also uneducated; the ranks of the profession—if profession it could be called—were recruited from all the failures in other paths of life, cripples and consumptives not being excluded. Many teachers, weak with the decrepitude of age, dragged out a miserable and hopeless existence, racked by the noise of pupils who learned nothing, to whom they were able to impart nothing. To such teachers was the education of nearly a third of the children of England entrusted. In 1861, a
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came the ruling principle, and as a natural consequence H.M. Inspector played an important part in directing the education of the schools. The grant for the backward child had to be earned; the slow boy could not be neglected for the sake of his more brilliant classmate; the teacher became the slave of the managers, a mere grant-earning machine. As far as real education is concerned, education as we understand the term, this system failed to produce the results claimed by its advocates. It created a new word, cram—a word that stands for the negation of all real mental training. Mr. Lowe and his colleagues worked for ten years, firmly convinced that there is no such thing as a science of education. Under a regime of mechanical examinations there settled down on the elementary school a monotonous and lifeless uniformity. A subject that could not be examined, and attainment in which could not be tabulated in examination tables, was unfit to be included in the school curriculum. It is astonishing with what persistency the low ideals of the pernicious "payment-by-results" system have dominated primary education during the last forty years. The worst product of it is the 100-per-cent. teacher, the man whose horizon is bounded by examiners' fads, and who, by a wise process of elimination, manages to anticipate an inspector's questions.

Another step in advance was made by the committee on education set up in 1871. Huxley was a member of it, and his presence was a sure indication that no effort would be spared to break away from the traditions of the past. He saw that the existing forms of education were the mere survivals of the needs of past ages, and that it was the duty of the committee to make provision in the school for modern modes of thought. Hence, Huxley moved for the formation of science and art classes in connection with public and elementary schools. In his address he put forward a strong plea for the introduction of lessons in physical science. "The country could not possibly commit a greater error than in establishing schools in which the direct applications of science and art were taught before those who entered the classes were grounded in the principles of physical science." He himself showed the way by establishing in his regular classes a system of science teaching, based upon laboratory work by the pupils. "It involved the verification of every fact by each student, and was a training in scientific method, even more than in scientific fact." There succeeded an age of activity in the direction indicated, the new education of the day being heralded by the publication of a series of science primers for schools; but the promoters forgot again the fact that the emphasis in education must be laid on the teacher, and not on schemes and regulations and text-books. The memorising of the generalizations of these text-books was substituted in the schools for training in scientific method, as initiated by Huxley.

In these colonies we have passed through phases of a similar character. The untrained and uneducated teacher has been a barrier across the path of reform; the examination fiend has held us tight in his inexorable grip; we have substituted a semblance of knowledge, scientific and literary, for the reality of knowledge itself. Now we are passing through a transition stage; and we modestly indicate our aspirations by using such epithets as "real," "new." There can be little doubt that our primary schools are receiving a baptism of fire; and the changes taking place in the foundation stages must affect the secondary schools and the universities.

It is within the scope of this paper to discuss only the aspect of this movement as it bears upon primary work. In passing, however, we may note the gradual changes taking place in the ideals of University education—changes tending in the direction of making these institutions count for more in national well-being. Public opinion first called into being the University extension movement; and the same force compelled the recognition of provision for the higher education of women. These movements, together with the establishment of University colleges, with curricula suited to modern requirements, have had a most vital significance in the furtherance of our national ideals of education. The establishment of technical schools has developed the ideas of all-round education in another direction; and not only so, but has influenced to an appreciable extent primary instruction. The cry of these schools has been that their progress is hampered by the bookish nature of the elementary work; that in some subjects, drawing especially, the instruction is most inadequate, and that training in manual aptitudes has been almost entirely neglected. The necessity for co-ordination of work in these several stages demands a central controlling authority, for without it the several grades are likely to work on independent lines; each class of schools indifferent to the needs of those immediately above or below. Secondary education left to the chance of private enterprise, and technical schools, working according to the whims of successive managers, must imply conditions inimical to any system of educational co-ordination. The pupil ought to pass as easily from primary to secondary school, and from the latter to the University, as he does from one class to another under a system of absolute freedom of classification.

The movement in the last fifteen years towards the betterment of conditions of education during the years of plasticity has centred round the teacher himself. Every effort is being made to make him efficient, and, given such efficiency, all minor details of school organisation and management may well be left to his judgment. Dr. Butler, noting the effect of training on the primary school teachers of America, and comparing the tone of the schools under such men with that of secondary schools taught by untrained men, boldly asserts:—"Perhaps no secondary school or college in America can show teaching to compare, in mastery of scientific method and in technical skill, with the best teaching to be seen in many of the public elementary schools, particularly in the Western States. In consequence of this, we may safely assume that pupils fresh from the vigorous, intellectual, and moral growth of a well-conducted elementary school will turn aside with disgust from the machine methods and dull, uninspiring class-exercises of our average academy. The new educational life-blood is flowing most freely and vigorously in the veins of the elementary teacher." What, we ask, is the essential element of such training? The teacher is primarily dealing with mental processes and mental growth; hence it is essential that all his training should be based on accurate knowledge of the nature of such mental processes—in other words, his training must be grounded in psychology. Is reading, writing and arithmetic the objective of the schoolroom? No; if it were so, anybody could take a book in hand and hear lessons. But when we consider that the master's business is to train heads to think accurately, hearts to feel sympathetically, and hands to do what is right, the difficulties of his work become apparent. It is one of the most pleasing features of the recent advance in method that psychology, hitherto a battle-ground for the warring theories of useless philosophies, has become the most intensely interesting of all practical sciences in its application to the theory and practice of education. No teacher worthy the name can now neglect the study of such books as Lloyd Morgan's "Psychology for Teachers," James's "Talks to Teachers," and John Adams' "Herbartian Psychology." The study of the science of psychology has taught teachers to lay the emphasis on the development of the pupil and not on the learning of subjects. In the words of Adams, the master needs to know more about John than about Latin. As soon as teachers begin to examine their work from the point of view of psychological method, they lose faith in the formalisms of tradition. Necessity forces the duty upon them of adapting themselves to all the various aptitudes of the individual pupils in their classes. In other words, they are led to think not only of a class of children, but also of individual children, diverse in disposition, in aspiration, in attainment, in mental capabilities. The problem set before the teacher in this view of education is not at all an easy one to solve.

Under such a view as this can a schoolmaster's work be mean, cramping, narrowing? Is it not rather the most difficult, the most broadening, the most uplifting work a man can engage in? An archbishop was once asked, "What kind of a man is Edward Thring?" The archbishop was about to poke the fire. He paused, and, holding out the poker, said, "Why, he was this kind of a man. If he were poking a fire, he would make you believe that the one thing worth living for was to know how to poke a fire properly!" Read the life of the great master of Uppingham, and it leaves this impression on the reader that there is one supreme thing to do in the world, namely, the management and training of boys. Such work requires all the energy and enthusiasm of the best men; it requires nothing short of the devotion of one's whole manhood. There is nothing small. nothing narrowing in it. Those who speak of the narrowness of the schoolmaster's work have never been true teachers, have never seen such at work; they have never known the divine enthusiasm that glows in the minds of those who are shaping the life and the character of a nation's youth. Thring's leading principle was that the dullest and most uninteresting boy was as precious in his eyes as the most brilliant. "Give every boy due attention," said Ruskin, "but spend most time on the brilliant ones." Edward Thring would probably reverse that. At Eton he had seen boys massed in large classes, and all the teaching directed towards the brilliant ones intended for the honours of the University. This struck him as the greatest defect of the school. Small classes for the teacher, and not more than 30 boys under the care of one master in a boarding-house, were two of the principles he carried out with iron determination. To be successful, each class-master and each house-master must individualize. Boys must be taken as units, each with his separate distinctive life: not in masses as parts of a great educational machine. One of his maxims was: "The teacher deals with latent powers; he does not hammer in a given task."

Under one aspect a teacher's work is visible, and capable of some degree of classification; under the psychological view it is unseen and incapable of estimation, but none the less real and lasting. For the schools a certain definite syllabus of work is prescribed; each year's course is limited by a "thus-far-and-no-less" mandate; an examination gauges the quantity of information assimilated by the learner from the year's instruction, and there the matter seems to end. But this course of instruction may be pursued year after year without, at the same time, doing much to build up the mental faculties, without due guidance of the emotional capacities, and even without any proper regulation of the active powers. But this training and this guidance and this regulation is, after all, real education, the result of which can be measured by no scale of graduated percentages. The true teacher is he who, in the course of imparting the knowledge prescribed, always keeps steadily in view the latter ideal of his work, namely, education as a means of perfecting mental growth and development. This is the side on which the Greeks of Plato's day laid most stress; it is the side the utilitarian of these modern days is in danger of neglecting. Amongst the youth of Athens the end of physical training was the perfection of manly beauty and the preservation of bodily health; so the object of mental training was knowledge for its own sake, and for the discipline of the mental powers. In this hurrying age we seem in danger of mistaking the means for the end. Athletics is made an end in itself: to many the settled business of life, to others the one absorbing topic of conversation. In the mental department we have taken up the same false attitude. Fact crowds upon fact in chaotic disorder. Time is precious and the best teacher is he who can impart the greatest amount in the shortest time, no matter how the organism fares in the hurried process of packing. The education of thinking, feeling, and acting powers is kept in the background to give place to tangible and showy results. The "know thyself" of Socrates was the keynote of the ancient system; "know the examiner," has come to the front in a generation given up to competitive examinations.

Notwithstanding these aspects of modern school life, there is much evidence that the stage of emancipation for the teacher is close at hand. The days have gone by when the charge can be laid against schoolmasters that, while the blacksmith may be deep in iron, and the shoemaker in leather, he alone of those who deal with mind is content to be ignorant of mind. The principles of psychology are permeating the whole process of his work, and influencing his methods in many important directions. It may still be argued:—Yes, the teachers know *something of the* groundwork of the sci*ence of education,* but is it possible to make any use of this knowledge in the practical daily routine of the schoolroom? To those who are alive to the nature of recent changes in method and alteration in the point of objective in educational effort the answer is plain. Given increased skill, due to years of efficient training, and certain freedom in classification of pupils and arrangement of work, and marked changes are at once apparent in the buoyancy and general tone of the classrooms. Let us take one example. Recently, in New Zealand, the incubus of a rigid individual examination of pupils has been dispensed with. One result is, that inspectors have been relieved from the labour of much mechanical drudgery, and are able to give more time to assisting teachers in their methods. Then the teachers also, feeling themselves trusted, and given more responsibility than under the old regime, have responded with vigorous confidence. Reading between the lines of recent inspectors' reports we may summarise the results from the teachers' point of view as follows:—"Relieved from the responsibility and the overburdening anxiety of an impending examination, they move in a lighter and freer atmosphere, and are able to turn from the consideration of the necessity of getting their tale of bricks completed to that of the question how the lessons shall be laid before the children most effectively. They are more at liberty to study methods, and can make it their aim, not so much to ensure that a certain amount of knowledge shall be gained as that the instruction shall be given in the manner most conducive to its due assimilation." In other words, the teacher can rise above the drudgery of imparting information, and can make a brave attempt to overtake the higher part of his work—the quickening of the intellect, the purifying of the emotions, and the guidance of the nobler will.

Fortunately for the methods of the schoolroom the old faculty-psychology is now practically dead. This psychology produced such phrases as "training the reason," "cultivating the memory," "strengthening the imagination"; as if the mind consisted of separate compartments, each requiring a separate course of treatment. What was merely a logical analysis was exalted into a real one. Professor Findlay indicates the darkening of knowledge that took place under the disguise of such psychology applied to education:—"Milions of children have been set to learn spelling lists, because, among other grounds, this delightful employment will train the memory. Now, the most that can be said by a faculty-psychologist is that, by this exercise, the child will gain a faculty for acquiring similar lists of words hereafter, but he will gain no general faculty for recol-

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it is to manage children, if only
they are kept busy. Teachers who make use of this characteristic—teachers who show much skill in the invention and organisation of "busy-work" have no difficulty in maintaining discipline. Young children, on first entering our schools, exhibit these powers, if they come from homes where they have received due encouragement from their parents. The wise infant-mistress will not repress any spontaneity of the kind; she will skilfully make use of it. And what questions your little tots of four and five will ask? "Where is the wind when it does not blow?" asked a little fellow who could scarcely lisp the words he was using. And, again, when a severe rain storm was at its height: "Mother, has God turned on all the taps to-day?" "What is a policeman for?" asked the same child when walking down the street w.. his grandmother, noting the distinctive uniform. Among other things, he was told that his office was to keep people good A few days after he was being taken to a house to meet other children, and he was impressed with the necessity of correct behaviour: "Yes, grandma," he said, "I will be good; I will be as good as a policeman." He had logically reasoned that a man who kept people "good" ought to be a model of perfection himself!

Child-study has shown the value of such aptitudes and powers, and educationists do not fail to take the child along the path of least resistance. A happy combination of Kindergarten and Quincy methods has led to a revolution in infant-school teaching. Froebel's methods had serious limitations; hence the amount of mystical nonsense that gathered round the "gifts." But the modern adaptation is a transformation of the old, due partly to Colonel Parker, but mostly to the divine vitality of the hundreds of infant mistresses who are quietly and unostentatiously performing the noblest work in the profession. The blunderers of the past set immature pupil teachers to train the infant classes; it is part of the glory of the present that the best and most sympathetic women in the service are now secured for this work.

Take, by way of example, another aptitude of the young child—the power of observation. Will anyone deny that the bookish work of the past has been a potent means in smothering all the pupil's proclivities in this direction? A noteworthy feature of modern methods of education is the tendency to depart from the old book-learning ideal, and to cultivate and train on right lines those instinctive powers of observation already referred to. In the past the child has been too much of a passive entity. His active powers were exercised in crude attempts at drawing stiff inartistic forms or in placing yards of unintelligible figures on a slate and then rubbing them off again. He reduced marvellous fractions to uncommon denominators, and spent much time in calculating when the hands of a clock would be together, while inwardly praying that the said hands would hurry on a little faster. While performing transmutations on thousands of pounds changed from one stock to another, the only objective reality he was ever likely to come in contact with was the question of the number of marbles he could buy for a penny. In other words, his faculty of seeing and his faculty of interpreting were never exercised, but even subjected to positive check, by the school curriculum. The subjects under the new order that will change all this are geography and nature study. "Geography!" you exclaim. Visions of names, of heights of mountains and lengths of rivers, of capes and bays, swarm in the bewildered brains! How we agonised to learn the names of all these, to the accompaniment of a birch-rod! But now we take our pupils to the top of Geography Hill, which may be a spot in their own playground, and from that vantage point we commence our survey of this fair earth. Real rivers and mountains are substituted for marks on tattered wall-maps; where it is not possible to come in contact with actualities, pictures and lantern views are shown; models in clay or plasticine are made in the presence of the children and by the children. Geography and Nature study combined and co-ordinated will prove in the future the means of developing the observational powers to an appreciable degree. Redway puts this aspect very tersely when he says:—"The reading method might fit a young man to be a private secretary; the discovery method fits him to be the employer of private secretaries. Anything that gives me self-power to discover and acquire knowledge is good; anything that gives the teacher self-knowledge in the place of a reading acquaintance is equally good. There is a wonderful strength that comes from the knowledge of contact; it is as solid gold compared with paper tinsel..'

Another subject that has recently been introduced into the primary schools to meet the needs of child activities is handwork. Modelling in plastic substances and in cardboard, brushwork drawing, carton-work, and woodwork, are all splendid aids in directing the energies of children towards self-realisation of all the bodily and mental powers. Hand, eye, and brain are trained to operate in one self-acting unity. Teachers find that the two hours every week devoted to one or other of these forms of handwork are *really two hours* gained in buoyancy and *mental reaction* when the time comes round for the book-lessons again. Then, what a splendid training in accuracy and care the woodwork exercises are! When a boy tries to fit his lap-joint or his dove-tail he finds that "near enough" is a bad maxim to work upon. "We don't send our girls to school to learn cooking," you say. No, perhaps not; but you would like them to be clean and orderly, and trained in all those habits that tend to make home sweet, and life enjoyable. There is another aspect of these innovations, an aspect that only teachers will notice. In school-life, sport often helps a dull boy to retain his self-respect among his companions. So with handwork. The boy at the foot of the class may be easily first at the bench. To the boy, one first is as good as another. In the past, effort has been directed too much to the training of head-workers only; handwork is making school-life endurable to those who can never be head-workers. Further, if a boy is to be a doctor or a lawyer, does he not require a sound guidance in careful accuracy? Surely, as much as, if not more than, the mechanic needs. The training in school-life should be general and not special; in growing children we must guard against over-specialisation, for it may mean interference with the natural order of development. Teachers find that handwork is resulting in habits of inquiry on the part of their pupils, and thus tends to make school-life less hard, less monotonous, and less a matter of antagonism. Such work in our primary schools will lead to a much higher level of national intelligence, and we know that a high average intelligence is the only safeguard of a democracy.

Time will permit only a passing reference to the efforts made to improve the surroundings of the pupils. School hygiene has come to stay; it demands close attention to all matters of health. Lighting, ventilation, seating accommodation, eye and ear-testing, examination of teeth come under its searching eye. Nor can we deal now with æsthetic considerations—the beautifying of the walls with works of art, the orderly arrangement of flower plots to fill the unused parts of the playground.

Only the fringe of this subject has been touched upon. Enough has been said to indicate that a great and momentous movement is at work all over the thinking world. Sad will be the fate of the State that does anything to cripple the advance of education in its midst. It must drop to the rear in the march of the nations. The best asset any country can possess is a thoughtful, observant, active, strong people. There are gold mines of wealth in our public schools, knew we but how to work them.

A new era is dawning for the teacher, an era of strenuous endeavour and tardy recognition. He dreams of work under better conditions, both for himself and his pupils. He hopes for schools that will meet all hygienic requirements; buildings and playgrounds and furniture all ministering to that quiet, restful, æsthetic atmosphere that should pervade all his work. For him the gates of art have opened a little way to give a vision of the perfection that recedes for ever and for ever as he advances—a perfection to which he aspires, but which he never attains. Nevertheless, he hopes to be numbered amongst the "high men" of Browning's lines—

"That low man seeks a little thing to do,
Sees it and does it:
That high man, with a great thing to pursue,
Dies ere he knows it."

Mr. Clemes said that, as the oldest teacher present, he would like to say a few words on the very able paper read by Mr Johnson. He remembered the system of primary education in England 50 years ago, referred to by the lecturer, having been in a private school at the time. They learned a great deal more in private schools then than was taught in any of the State-schools. Lowe's principle of payment by result made scarcely any difference to the private school teaching, but wholly to the Board-schools, which took the place of the National and British schools, the former conducted by the Church of England, while the latter were undenominational. Huxley's work dealt mainly with secondary schools. He was in Switzerland when the technical schools, borrowed from thence, were introduced into England. These were used by the manufacturers as a means of improving the technical skill of their work-people, which was clean against the idea of all true educationists, who desired to train, not plumbers and carpenters, but the science that underlay the art that was to be learned in the workshop. Referring to America, the speaker said that the primary school teachers there, especially in the west, were nearly all young women. And a great deal of the higher education in America was also in the hands of women. He hoped that the training-school was not going to enter into competition with the secondary schools. The time had not come to try and cripple the secondary schoolmasters. (Applause.)

Dr. Delany said the drift of Mr. Johnson's paper was quite in harmony with what he desired for the education of the children—that the teachers should be specially trained, and that they should enter into the attitude of the child. The formation of character, which was one of the main elements of the new education, could not be successfully carried out on basis so unstable as the emotions, but must be grounded on the conscience, an all-important element which was not attended to by the Greeks. Mr. Johnson had made the happy remark that the school should follow the home. An eminent Frenchman had said that the school could give instruction, but was powerless to give education, which could only be obtained in the home. If that were true, as he was inclined to believe it was, it was important that the school teacher should occupy the place of parent to the child, and thus the continuity between the home and the school life of the child should not be broken. (Applause.)

Mr. R. Smith, headmaster of the Battery Point State-school, said that his attention had first been called to the newer developments in education seven or eight years ago by letters from America, placed in his hands by the late Sir Edward Braddon, asking children here to correspond with children in America on natural history and other subjects. A correspondence thereupon ensued between the children here and there, which had been of great advantage to both sides, and had been the means of dispelling a great deal of ignorance about the different countries between which the correspondence was conducted. He gave a striking illustration to show the value of a suggestion by Mr. Johnson to teach different subjects—mental and manual, for instance—so as to reach all sorts of minds. One of the boys attending his school had been completely given up by the teachers as utterly hopeless and incapable till the band was introduced, when he was the very first to attain proficiency, and from that time an entire change for the better took place in his life. (Applause.)

Hon. Herbert Nicholls, M.H.A., ex-Minister of Education, said that Mr. Johnson's lecture struck him as sounding the drum which was to signalise the freedom of one very much wronged individual—the child with a character. The child who could reason out a problem of Euclid but could not memorise it had been the victim of previous systems. Henceforth, he was glad to know, that the character of the child would be recognised as the important thing to be studied. Australian and Tasmanian children did not lack individuality and originality, and if they were allowed to develop in their own way, they would have a far more vigorous and intelligent community in the future than they had ever had in the past. (Applause.)

Hon. W. B. Propsting, M.L.C., Minister of Education, said if Mr. Johnson's paper enabled the bulk of the people to realise what the new education meant a great deal would have been achieved. It meant that in the future children were not to be treated as machines to carry away as the result of their schooling a mass of undigested information of very little use, but as intelligent human beings to be given a mental experience, which would enable them to develop all their faculties, so as to be able, when they left school, to confront the varied problems of life in a satisfactory manner. The aim of the paper had been apparently mistaken by Mr. Clemes. It was not an advocacy of the control of the whole of education by the Government. For his own part, he would be delighted if the whole of the educational work of the State could be undertaken by private enterprise, so long as it was efficiently done. Private enterprise was doing, and had done, a very large and important part in this and the other States, but a large number of parents could not afford to pay for a private education, and so the State stepped in, and undertook the work. And the State was endeavouring to see that the children were given the very best possible education that could be provided. Ten per cent., perhaps 20 per cent., of a child's life, and that the most important period, was spent in school. It was handed over to some master to train, and the State had determined that for so vitally important a work the teacher should be trained. That was the reason why they had started the training school, and in Mr. Johnson, he felt sure, they had the right man in the right place. In a democracy such as theirs, the people governed the country, and it was therefore of the utmost importance that the people should be educated. This was being done by the State. After relating an anecdote to show the value of Sloyd teaching, Mr. Propsting concluded by thanking Mr. Johnson for the very able paper he had read.

His Excellency said it was a very great pleasure to him to see around him those engaged in education work in Tasmania, the prominent instructors in private schools, the prominent masters of secondary schools, two Ministers of Education, and other leaders of thought. He felt the Royal Society was performing a useful work in affording an occasion upon which these questions could be discussed in a scientific light. The touchstone of Mr. Johnson's fascinating paper might be found, he thought, in one of the earliest remarks in it, that the new education was not new. One of its principal characteristics was the differentiation between education and instruction. Education might be divided into education of the attributes of the mind and of the body. Instruction comprised every branch of learning—human and divine. Where to draw the line between the two had been the problem and the mystery. He remembered the first time he was in the Tasman Sea between New Zealand and Australia. That was education. At that time he had to cram up a whole lot of information from books to pass the matriculation examination at Cambridge. That was instruction. He did not agree with Mr. Johnson in his analysis of the bearing of Plato's views on education. It was true that it was largely aimed at developing the physical qualities of men and women as animals, and beauty for the sake of beauty in an æsthetic spirit, but the founder of that system of education had another thing in his mind, and what the most earnest and puzzled thinkers of Australia had in their mind now, the connection between education and the problem how to protect the Commonwealth from danger. After glancing at later systems of education, His Excellency went on to refer to the principle of competitive examination, for which he felt great contempt, but he did not sneer at the examiner at competitive examinations, who was a creature of circumstances. After praising the modern organisation of training colleges His Excellency touched on one of the drawbacks of democratic government, the enormous difficulty of getting rid of incompetent, worn-out, or out-of-date servants. The remedy for this, in his opinion, was an adequate and generous pension system for school teachers. After some further remarks, His Excellency proposed a hearty vote of thanks to Mr. Johnson for his interesting and able paper. (Loud applause.)

In acknowledging the vote, Mr. Johnson corrected a misunderstanding by Mr. Clemes as to the use of the word private school in England 50 years ago. The schools referred to by Mr. Clemes were not the ones he had had in his mind, but the primary schools, where the children of the poor were educated.

This terminated the business, and the meeting closed.

## OCTOBER, 1906.

No meeting in October.

## NOVEMBER, 1906.

On November 8th, Professor W. Baldwin Spencer lectured before the Society on "The Australian Aborigines."

Other business was postponed, including a paper by Colonel W. V. Legge, R.A., on *"Ben Lomond"*

## Statement of RECEIPTS AND DISBURSEMENTS for the year 1906.

| RECEIPTS. | £ | s. | d. | DISBURSEMENTS. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Balance from 1905 | 27 | 7 | 2 | Salaries | 60 | 13 | 4 |
| Contributions of Fellows | 108 | 0 | 6 | Grant to Medical Section | 12 | 0 | 0 |
| Proceeds of Professor Spencer's Lecture | 12 | 19 | 0 | The Government Printer—Printing | 7 | 14 | 0 |
| | | | | Messrs. Davies Bros.—Printing | 30 | 0 | 0 |
| | | | | *Tasmanian News*—Printing | 6 | 8 | 0 |
| | | | | Messrs. Walch & Sons | 10 | 0 | 0 |
| | | | | Mr. Oldham—Lantern | 4 | 0 | 0 |
| | | | | Mr. Gilbert—Collecting | 4 | 0 | 0 |
| | | | | Petty Cash, Stamps, etc. | 4 | 15 | 2 |
| | | | | | £139 | 10 | 6 |
| | | | | Balance to 1907 | 8 | 16 | 2 |
| | £148 | 6 | 8 | | £148 | 6 | 8 |

I have this day examined the books of the Royal Society of Tasmania, and certify that this statement is in accordance with them.

March 27th, 1908.

H. W. W. ECHLIN.

## Statement of RECEIPTS and DISBURSEMENTS for the year 1905.

| RECEIPTS. | £ | s. | d. |
|---|---|---|---|
| Contributions of Fellows, including Two Life Members ... ... .. ... ... | 141 | 10 | 0 |
| | £141 | 10 | 0 |

| DISBURSEMENTS. | £ | s. | d. |
|---|---|---|---|
| Dr. Balance from 1904 .. ... ... ... | 6 | 7 | 5 |
| Salaries ... ... ... ... ... ... ... | 60 | 13 | 4 |
| Messrs. Davies Bros. Ltd. ... ... ... .. | 20 | 0 | 0 |
| *Tasmanian News* ... ... ... ... ... | 7 | 3 | 0 |
| Martin, Caterer ... ... ... ... ... | 4 | 0 | 0 |
| Mr. E. Chancellor ... ... ... ... ... | 2 | 13 | 0 |
| Mr. Oldham—Lantern ... ... ... ... | 2 | 0 | 0 |
| Hobart Gas Co. ... ... ... ... ... | 2 | 0 | 10 |
| Sundries, Petty Cash, Stamps, etc.... ... ... | 9 | 5 | 3 |
| | £114 | 2 | 10 |
| Balance to 1906 ... ... ... ... ... | 27 | 7 | 2 |
| | £141 | 10 | 0 |

I have this day examined the Books of the Royal Society of Tasmania, and certify that this statement is in accordanc with them.

27th March, 1908.

H. W. W. ECHLIN.

# RECEIPTS and DISBURSEMENTS for the year 1904.

| RECEIPTS. | £ | s. | d. | DISBURSEMENTS. | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| Balance from 1903 | 10 | 1 | 5 | Salaries | 51 | 6 | 8 |
| Annual Contributions of Fellows | 100 | 11 | 0 | Messrs. Davies Bros., Printing | 20 | 0 | 0 |
| | | | | *Tasmanian News* | 4 | 10 | 0 |
| | £110 | 12 | 5 | Messrs. Walch & Sons | 10 | 0 | 0 |
| Dr. Balance to 1905 | 6 | 7 | 5 | Grant to Medical Section | 12 | 0 | 0 |
| | | | | Insurance | 4 | 10 | 0 |
| | | | | Hobart Gas Co. | 3 | 9 | 6 |
| | | | | Auditor's Fee | 1 | 0 | 0 |
| | | | | Mr. Oldham—Lantern | 3 | 0 | 0 |
| | | | | Mr. J. W. Beattie | 2 | 1 | 6 |
| | | | | Philosophical Society of Canterbury | 1 | 1 | 0 |
| | | | | Petty Cash, Stamps, Telegrams, etc. | 4 | 1 | 2 |
| | £116 | 19 | 10 | | £116 | 19 | 10 |

I have this day examined the books of the Royal Society of Tasmania, and certify that this statement is in accordance with them.

27th March, 1908.

H. W. W. ECHLIN.

# Royal Society of Tasmania.

The annual meeting of the Fellows of the Royal Society of Tasmania was held on July 9, 1907. Mr. A. G. Webster presided, and there was a fair attendance. The report and balance-sheet were presented by the Sec. Mr. Robert Gould was elected a Fellow of the society.

The Chairman moved the adoption of the report and balance-sheet, and stated that the Council had under consideration the question of revising the rules, and a special general meeting would be called to consider the recommendations.

Mr. Russell Young seconded, and in the discussion which followed on the affairs of the society, Mr. E. L. Piesse suggested that more should be spent on the publishing of the proceedings of the society, and greater efforts made to secure new members.

The motion was agreed to.

There being no other nominations, the retiring members of Council, Sir Elliott Lewis, Messrs. A. G. Webster, R. Young, and R. M. Johnston were re-elected.

# *Royal Society of Tasmania.*

## REPORT FOR 1906.

Meetings of the Royal Society have been held during the winter session for 1906 in the months of May, June, July, August, September, and November.

The following papers were read :—

May 8th—"Some developments in 1905-6 conducive to Tasmania's Progress."—His Excellency the Governor.

June 11th — "The Biological Ancestry of Human Diseases."—Dr. Gerard Smith.

June 11th — "Democracy and Socialism."—Mr. E. C. Nowell.

July 11th — "School Hygiene."—Dr. Elkington.

July 11th — "Notes on King Island and recent Discoveries."—Messrs Morton and Johnston.

July 11th — "Geology of King Island."—Mr. R. M. Johnston, I.S.O.

August 15th — "Tasmanian Emu."—Col. W. V. Legge, R.A.

August 15th — "Some notes on the Propagation of the Cucumber Herring."—Mr. C. H. Harrison.

August 15th — "Aboriginal Stone Axes."—Mr. Alex. Morton.

August 15th — "Schouten Peninsula." — Mr. J. W. Beattie.

September 10th — "The New Education."—Mr. J. A. Johnson, M.A.

November 8th — "Australian Aborigines." — Professor W. Baldwin Spencer, F.R.S.

### CORRESPONDING MEMBERS.

Two new Corresponding Members were elected during the year, Messrs. W. Heyn, and P. St. Michael Podmore.

### NEW FELLOWS.

Ten new Fellows were elected and three resigned.

Four members of the Council, Messrs. A. G. Webster, Russell Young, R. M. Johnston, I.S.O., and Sir Elliott Lewis, retire, but are eligible for re-election.

## JANUARY 2nd, 1907.

### AUSTRALIAN ABORIGINES.

### LECTURE BY DR. KLATSCH.

A large audience assembled on January 2, 1907, in the Royal Society's room at the Tasmanian Museum to hear a lecture by Dr. Herman Klatsch, Professor of Human Anatomy at the University of Heidelberg, on the habits, customs, and ceremonies of the Australian natives. Mr. A. G. Webster presided, and amongst those present was Dr. Delany, Bishop of Laranda.

At the outset Dr. Klatsch explained the object of his visit to Australia, namely, to study the skulls of the aborigines, which Huxley had declared bore a striking resemblance to fossil skulls found in Europe. Huxley's assertion had, the Professor said, been absolutely confirmed by his investigations. In addition to studying the skulls of the natives, he had sought to study their bodies generally, and for that purpose had measured some three hundred of them in various parts of Australia. He came to Australia in 1904, and first settled in Brisbane, where he made the acquaintance of Dr. Roth, who placed his great collection of skulls at his disposal. In making his investigations he had also received great assistance from the Governments of New South Wales and Queensland. The Government of the latter State had furnished him with a vessel in which he had circumnavigated Australia, and also made a trip to Java.

The Professor then proceeded to speak at some length on the results of his examination of the aboriginal skulls, and pointed out in the diagrams projected on a screen the remarkable prominence about the eyes, which was a point of resemblance to the fossil skulls of the earliest period found in Europe. He then directed the attention of the audience to reproductions of photographs of natives taken in various parts of the continent. The first group shown was one of Archer River natives, whom he described as fine athletically-built men, and very intelligent. He found them, he said, good material for investigation, but encountered great difficulties at the outset. He succeeded, however, in winning their confidence by performing an operation on an old woman, and thenceforward all was plain sailing. The missionaries living amongst the people appeared to the professor to have anything but a pleasant time of it, and he wondered very much how they continued to live there. After alluding to the fact that polished stone implements were *rarely* found in that particular part of
Australia, the Professor describ
danger which he incurred in diggi
a grave in order to obtain a skelet
blacks threatened to spear him;
quote the professor's own words:
the place very quickly one day, an
then I have been more careful wl
I have opened a grave." The pe
that part of Queensland were dy
rapidly. They lived very fre
with Chinese, who introduced
among them, with fatal effects
introduction of the drug was pro
by law, but the law went for n
The missionaries did their best
unfortunate people, but had n
ceived the assistance they deserv
natives inhabiting the region i
vicinity of the Bellender Ker Mo
were of a superior type. They
intelligent enough, and assiste
whites in gold-mining. It was
erroneous, the Professor declar
think them incapable of workin
facial characteristics of those
strongly resembled those of the
of the Northern Territory, and c
Australia; a fact which, to his n
dicated that they had all sprun
the same primitive stock. In t
trict Professor Klatsch was succe
obtaining possession of a mu
corpse, and the means to which
resource constituted a quaint
comedy. He went to intervie
relatives of the departed with his
full of tobacco, etc., and made
for the mummy. The weed a
to the young members of the
but the mother strongly obje
the whole proceeding. However,
prevailed over sentimental co
tions, and the professor obtained
sion of the mummy. But even
was not out of the wood, for n
the young people, instigated by
portunate mother, demanded the
of the body. It was then the pr
turn; he demanded the refund
tobacco, and before anything
eventuated, left the district.

Leaving Queensland, the Profe
tinued his investigations in W
tralia, visiting Broome and W
The latter place was rather n
and unfavourably so, on accoun
blacks in that district having
treated by the whites. In the
the Professor, Wyndham was in
in which Tasmania was between
1830. A black war was going o
where there was an enormous n
blacks, and in consequence of th
with the whites, it was impos
approach them. They regarde
white man, if a little better dres
usual, as a policeman, and to

an was a dangerous animal. They a distinction between a policeman ordinary white man.

Port Darwin natives were next the of the Professor's observations. ild, he said, be a great pity to hem to die out. They were able k, and of them it could be safely hat they had a future. He con- his very interesting account of his nces by describing his visit to le Island.

Alex. Morton, after alluding to of the Professor's theories, said was quite possible that he would to Hobart again, and deliver his in a more popular form to a mixed audience, and also to school children.

Dr. Delany moved a vote of thanks to the lecturer. There were two points on which Dr. Klatsch had borne strong testimony; one was the ill-treatment of the natives by the whites; the other was the admirable work done amongst the blacks by the missionaries of all denominations.

The vote of thanks was carried by acclamation.

Dr. Klatsch, in returning thanks, said his reason for desiring to deliver a popular lecture was that he was convinced that the ill-treatment of the natives was in the main the outcome of ignorance.

# OPENING OF THE 1907 SESSION.

## ABSTRACT OF PROCEEDINGS APRIL 29th, 1907.

### INVENTIONS AND DISCOVERIES FOR THE YEAR.

The opening meeting for session 1907 of the Royal Society of Tasmania was held on April 29th. His Excellency the Governor, Sir Gerald Strickland, president of the society, occupied the chair, and was accompanied by the Lady Edeline Strickland, and attended by Mr. George Browne, I.S.O.

Apologies were read from the Mayor, Colonel Legge, and Mr. Bernard Shaw; also from the secretary (Mr. Alex. Morton), who, to the regret of everybody, is still laid up with illness.

Mr. R. M. Johnston, the acting secretary, feelingly alluded to Mr. Morton's absence. This was the first occasion, he said, on which Mr. Morton had been absent at the opening evening meeting of the session for twenty-four years. Not only this society, but kindred societies and institutions owed a great deal to Mr. Morton's great energy, skill, and noble self-sacrifice. (Applause.) He trusted their esteemed secretary would soon be restored to health to resume his noble work of the past 24 years for this and other institutions in the community. (Applause.)

### The President's Speech.

The President, who was cordially received, said:—

Mr. Vice-President, Ladies, and Gentlemen,—

It is usual to open the annual session of the Royal Society of Tasmania by reviewing topics of scientific interest, which have deserved attention in the previous twelve months, and to inquire how far new discoveries in mechanics, engineering, and the arts, may have a special bearing on the future progress of this State.

At present the economic conditions of Tasmania are decidedly prosperous, not only on account of good agricultural returns from wool and apples, but largely on account of the continued high prices of metals. It has been suggested that the high price for all other metals necessarily involves a corresponding fall in the value of gold. This rudimentary proposition requires qualification; for example, in a country where all the currency is paper money, the economic law would not hold good.

Interest-bearing money has been current within recent history, and although such issues are theoretically reprehensible, there is evidence that a system approaching closely to interest-bearing paper money is looming large in our own times, under the guise of short-dated Treasury Bills, and of short-dated notes of railways or other commercial undertakings with current and established credit. The London County Council has indulged in this form of finance to the extent of some four or five million sterling, and paid interest as high as six per cent.

It is reported that already, for this year, in the United States, 165,750,000 dollars worth of short term notes have been placed with the public at rates varying from 4½ to 6½ per cent. The spread of this system of finance—and it is likely to last—accounts, probably, for the inflation of all prices, more than any superabundance of the stock of gold.

Moreover, operations in short dated paper on a large scale tend to show that titles or credit are taking the place of gold, to some extent, as the medium of exchange. These short dated notes are, in fact, for practical purposes almost equivalent to cash in the settlement of bank balances involving large transactions. They are indulged in because gold is scarce, and thereby the demand for gold, and for other metals, becomes more eager, and steadier; from this point of view the new development of finance enhances the future prospects of Tasmania's mining all round.

The great increase in the value of iron, and of iron ores, is also of good promise to this community. This rise has, possibly, come to stay, and we should lose no time in opening up our rich deposits of iron.

In the year under review, there has been great practical advance in continuous processes for the manufacture of iron and steel, and for the application of electricity to this object. An important factor in this general rise in prices of metals is the great prosperity which the leading civilised nations are enjoying in a period of profound peace; as an example of the connection between general prosperity, and the demand for metals,

d mention that, in America alone,
,000lb. of copper is the estimated
isition for telephone extension by
Bell Telephone Company alone. For
office buildings in New York
,000lb. of copper are required this
Similar causes operate to keep up
value of lead, zinc, tin, and other
ls. The very vigorous advance of
Japanese adds to the demand for
ls. China is also really rubbing her
and is almost awake. Africa is
civilised very rapidly. South Amer-
s more and more progressive, and
oving towards a general adoption of
llic currency, in place of a bank-
circulation. Under these circum-
es the prices of metals are likely
ntinue on the upward grade, especi-
if wages do not alter appreciably.
smania has not got an agricultural
ge, but we enjoy great indirect ad-
ages from the training given to Tas-
ans at the Hawkesbury College, in
South Wales, and in other similar
tutions on the mainland; the bene-
onferred by such institutions, which
most scientifically and practically
aged, cannot be overrated. The
kesbury College has already been re-
ised as deserving of imitation by
n and South Africa, and simliar col-
are fast growing up all over the
d. King Victor Emanuel has given
ivate estate, worth £12,000 a year,
this work in Italy. Not only is
rate knowledge thus disseminated,
seful plants are discovered and im-
ed, and, what is more to the point,
discoveries are ungrudgingly dis-
nated and exchanged.

e greatest recent scientific novelty
the benefit of agriculture is the
ssful extraction from the air of
gen and nitric acid, at prices which
ete, commercially, with the nitrates
rted from Chili, as a basis of arti-
fertilisers. In this connection we
remember that Tasmania offers pro-
ng sources of water-power for the
ction of these nitrates by electricity.
has often been a matter of dispute
her birds do more harm than good,
the agricultural point of view; to
this problem, and distinguish the
l from the pernicious birds, system-
observations have been made of the
nts of the stomachs of various kinds
rds. It has thus been ascertained
h species live on fruit and grain,
which birds live on insect pests, at
ent seasons, in America. In order
such observations should be reli-
they should be repeated in Tas-
a, for the protection of the friends
he orchardists, and to indicate
ed pilferers that deserve extermina-

The dimensions of the great transatlantic steamers of the Cunard Company were brought to your notice last year.; these great vessels are to enter on regular work this season, and there is reason to believe the guaranteed speed will be largely exceeded. These gigantic steamers interest Tasmania, inasmuch as they hasten the day when large turbine vessels will be coming south of the Line, and when their owners will realise that Hobart is the most suitable deep-water harbour to be their headquarters, as a centre of distribution.

Mr. Parsons has already proposed to follow up his success with a turbine vessel, for war purposes, of 80,000 horse-power, to achieve 44 knots on a displacement of 2,800 tons. A German company has given an order to a Belfast firm to build a steamer still larger than the great Cunarders.

The year under review has been remarkable for wonderful progress with internal combustion engines operated by oil or by gas made in producers attached to the engines. The small manufacturer and the agriculturist finds these handy prime motors to be of great assistance in starting new industries. New factories, making gas and oil engines have been springing up all over Great Britain; nevertheless, they have been overcrowded with orders. Traction engines have lately been built, carrying enough oil and cooling water for 24 hours' work. Portable gas producer plants, with engines on the same frame, are making headway, and traction engines on this principle are in contemplation.

The thermal efficiency of a recent gas engine is reported to have reached 42 per cent., which contrasts most favourably with the 10 per cent. efficiency of the steam engine.

A marine engine of 3,500 horse-power, to be worked by producer gas, is under consideration, and a battleship has been designed to be propelled by gas engines, so as to dispense with stokers, funnels, and smoke. High authorities have expressed the opinion that gas-driven turbines were unworkable on account of the destructively high temperature of operation; but M. Armengand and M. Lemale, in France, and Dr. Stolze, in Germany, have advanced the problem to a practical stage. There is now near Paris a 500 horse-power gas-driven turbine running, which promises developments likely to be most welcome in the waters of the Derwent and the Huon, where a supply of anthracite is being opened out, and where gentlemen are eager to run their own yachts, and where everything that simplifies transit on the water gives added life to trade, and greater resources to settlers. The gas turbine would reduce coal consumption by one-half at least.

Mechanical flight has been publicly achieved in Paris by M. Santos Dumont and by M. Fillippe. But the honour of being the first to solve this classical problem of mechanics belongs to the Wright brothers, of Drayton, in the United States of America. These brothers followed up diligently for years the gliding experiments of Lilenthal, which consisted in maintaining a balance soaring down a gentle declivity on a double-inclined plane. The Wright brothers thus acquired the art of controlling their equilibrium on a machine heavier than air, and, having thus diminished the personal danger of the experiment, they applied a motor to their aeroplane, and made six recorded flights, ranging from 11 to 25 miles. They are mechanics by profession, and, desiring to obtain a well-deserved pecuniary reward for their labours, they ceased experiments as soon as they had solved the steering problem, so as to evade the photographer and others who might interfere with their obtaining patents, or keeping their secrets.

The American Government appears to have stepped in, and prevented any offer of the invention to some foreign power, so as to retain the services of the Wright brothers, and their future inventions for national purposes. The Wright brothers have since constructed a lighter and more powerful motor, and it is hoped that they will compete for some of the prizes recently offered for the navigation of the air. The total of these prizes now aggregates between £60,000 and £70,000.

M. Santos Dumont only flew 680ft. at 22 miles an hour, but he has just completed a new machine with a 100 horse-power engine, and, if he knows how to keep his balance as well as the Wright brothers, he appears to have many great prizes within his grasp, as it is doubtful whether the American Government will allow the Wright brothers to compete.

The latest victory over the air, according to Reuter's Paris correspondent, is operated by diminishing the pressure over the curved surfaces of an aeroplane, using rotating wings above it, so that considerable weights are supported in the air with little effort. There is a feature in this development which is specially interesting to Tasmanians. Many months before this announcement appeared, Professor McAulay, of our University, in a scientific discussion on the problem of flight, expressed an opinion that the solution would be found precisely in the way in which M. Fillipe has made progress. This is not the first time that genius has worked independently, on the same lines, in different parts of the world.

But, the question suggests itself, How do flying machines affect the material progress of Tasmania? It is anticipated that these machines, in the near future, *will not* cost more than a first-class motor-car; they will, therefore, make it easy for the prospector for minerals, and for the surveyor looking after the interests of closer settlement, to begin his work with a survey from aloft, instead of cutting his way through dense bush; and when he has discovered something good, he will not find it so difficult to keep in contact with civilisation.

Wireless telegraphy concerns Tasmania, because we hope to see this means of communication become cheap, simple, and efficient, so that it may be extended to the outlying islands of this State without delay. Several new systems have been lately developed, and the difficulty of interference has practically been conquered.

A case is reported from Paris of a youth and a maiden using an extemporised private wireless installation for amorous correspondence, unknown to their parents, which, in France, was looked upon as more awful than it would have appeared in an Anglo-Saxon community. In Germany wireless telephony has been successfully accomplished at a distance of 20 miles. This fact is, however, of little, if any, practical utility. Photographs have also been transmitted or reproduced as line drawings by electricity.

Wireless telegraphy has been adopted in Brazil to maintain communication across tracts of bush country where the upkeep of telegraph lines would be expensive. A company in America has started wireless communication with Scotland. Its first high iron support for the aerial wire has been blown down, but the promoters have not lost heart, and are re-erecting it.

The development of motor traffic may be illustrated by an order of four thousand cabs to run in the streets of London. These will be provided with "taximeters," which will indicate at a glance the distance and the fare as they progress. The fare is now fixed at 8d. a mile.

In America motors have been applied for logging, a precedent which might, in some situations, be worthy of attention in Tasmania. The use of alcohol for driving motors and for other industrial purposes is now well established in America and in Germany. In the latter country denaturalised alcohol for such purposes is sold at 8d. a gallon.

In the construction of lighthouses, a novelty comes from America, where a lighthouse has been built on a massive iron foundation, which was towed to the spot, to be sunk there and filled with concrete. The method might be applicable to some localities on our coasts where breakwaters are required.

The demands on the Niagara Falls for electric power have been increasing, and have developed a curious problem with regard to the current transported across the Customs border, between the United States and Canada, a strong agitation having arisen to charge duty on the current for the protection of local industry. Power has been carried all the way from Niagara to Toronto. It is proposed to carry power from the Zambesi River, some 700 miles to the gold mines of Johannesburg. We should inquire why Tasmania does not develop her water-power?

The earthquakes in San Francisco and Jamaica have given prominence to the advantages of "ferro-concrete," or structures of light iron framing, carefully proportioned to resist tensile strains, embedded in well-made and properly-seasoned concrete, so as to withstand compression strains. This combination, if properly designed, is both fireproof and earthquake-proof, and, by reason of its fire-resisting properties, it is receiving attention all over the world.

A great bridge, 2,800ft. in length, has been built over the St. Lawrence, at Quebec, in Canada, with a central span of 1,800. This is the greatest span yet attempted. A generation ago few would have dreamed that it would ever be wanted. It would about represent a connection over the Derwent from Queen's Battery to Montagu Point.

In no part of the world are the ocean waves so long as in Australian seas on account of the large unbroken expanse of deep ocean facing our shores. It is, therefore, interesting to record some accurate measurements that have been made of ocean waves by M. Bertin. The longest wave measured was 2,500ft. from crest to crest, and its period 23 seconds. The depth of this wave was estimated at 50ft. Waves longer than this may be met in the southern seas, but they are rare, and the common span of a long wave is about 500ft., and the period 10 seconds. When a wave coming from deep water strikes an elevation in the sea bottom its character is quite altered, and green seas are known to have risen to the height of 100ft.

A great engineering work has just been completed by English contractors in Mexico — a railway with harbours at either end across the Isthmus of Tehuantepec. This line is about 190 miles long, from the Pacific to the Caribbean Sea. It was projected when the cutting of the Panama Canal seemed abandoned, and it has been completed, with the object of direct competition, by low freights, against the Panama route. The use of the most modern appliances for transhipment has been adopted at the terminal harbours. This enterprise is of interest to Tasmania, because it opens the wealthy gulf ports of the United States to the Tasmanian apple trade, and it facilitates carriage to the whole Atlantic seaboard, pending completion of the Panama Canal.

The work undertaken by the United States on the Isthmus of Panama has been under the personal care of President Roosevelt. The difficulties and disappointments already encountered would have discouraged almost any other living man, but now the work is really progressing, and the engineers working on the Isthmus feel confident that success is within sight. The plan finally adopted is for a canal with locks at a level of 85ft. above the sea, and at a cost of £30,000,000 sterling. It is estimated that the work will require eight years. A canal at sea level would possibly have required twice the time and double the money. The completion of this canal is most important for the supremacy of the Anglo-Saxon race in the Pacific.

With regard to railway construction, the popularity of the motor coach appears established. In Germany, it has suggested the convenience of stopping along the railway at customers' residences along the line, as a tram would do. This system, called the "Halte system," has much to recommend it in new countries in course of development. The construction of railway carriages for express service, made entirely of steel, has proved to be a great protection against the results of railway accidents, these vehicles being proof against fire, and almost proof against any break up.

In naval construction, the British Dreadnought has marked a new epoch, and placed all former specimens of naval architecture almost out of date. She carries ten 12in. guns, and can steam at least 21 knots. A cruiser has just been launched, of the "Invincible" class, to steam 25 knots, and carry eight 12in. guns; she will probably steam 26 knots, or more.

Against such craft, torpedo boats and destroyers will be of little use. A torpedo boat has, even at night, to overhaul such a fast cruiser before launching a torpedo, and, at 2,000 yards, an 18in. Whitehead (with all the gyroscopes in the world) is only running at 22 knots. The chance of a stern chase is, therefore, very small indeed.

The new American 21in. torpedoes, with turbine machinery, can do 36 knots at 1,200 yards; but even at that speed the fast cruiser would only be vulnerable if approached at close range. It, therefore, appears that, except for attacks on battle fleets at anchor, or against ironclads crippled after an engagement the submarine, or submersible boat, has already taken the place of the destroyer for up-to-date coast defence.

The gun trials of the Dreadnought are reported to have shown that, in her design, the extreme offensive power obtainable with 12-inch guns has been reached, so that the new English battleships are to

13½-inch guns, throwing a shell of
, and weighing 85 tons.

n we remember that the Dread-
was only commissioned some six
; ago, and that it is only a year
half since the commencement of
ilding, we may realise how soon a
p becomes superseded, and how
t is for money to be wasted on
onstruction.

he German military manœuvres
vas a great display before the Em-
of armoured motors carrying field
They negotiated ascents of one in
and a half, and proved able to go
ny but the most difficult country.

onclusion, I venture to congratu-
asmania on the interest which the
of this State, both North and
has been showing in scientific
s. The numerous articles and
aphs which are constantly and pe-
lly appearing are selected and re-
ed with great judgment, and in a
r to command general interest with
ts of nature and of mechanical
ion.

Royal Society may justly ascribe
lf some credit for having made at-
to scientific subjects both popu-
d practical in this island. I trust
areer of usefulness may long con-
and that in this noble and elevat-
rk the most valuable and devoted
s of our secretary, Mr. Morton,
ng be spared, and that his recovery
e rapid and complete. (Warm
use.)

G. E. Moore, M.H.A., in the dis-
which was invited, said that the
why Tasmania did not use her
power was that she had no water-
hough she had sufficiently large
of water: but, in places,
alls might be constructed. The
ry of making nitrogen from the
ght be developed here with cheap
power. Ten thousand horse-power
be developed in one part of Tas-
that he knew of.

Mr. Clemes said he was intensely interested in the speech. The production of nitrogen from the air referred to in the address was an extremely interesting subject, and was calculated to effect wonders in connection with the cultivation of the land. There was sufficient material in the address for hours of discussion. (Applause.)

Senator Mulcahy refrred to what the President had said respecting iron production, and mentioned that in Tasmania, on the Blythe River, there was what experts pronounced to be one of the finest iron ore propositions in the world, and no doubt, sooner or later, it would lead to extensive iron and steel manufacture in Tasmania. As to water power, there were in Tasmania large bodies of water at high altitudes, which, according to reports of hydraulic engineers, might easily be tapped, namely, in the Lake districts. He believed that when the value of cheap water power was better understood in Tasmania, the State would become one of the best manufacturing States of the Commonwealth. (Applause.)

Mr. A. G. Webster moved a hearty vote of thanks to His Excellency for presiding, and delivering such an interesting address on scientific progress and speculation during the year.

The motion was passed with applause, and His Excellency briefly acknowledged the compliment.

Mr. R. M. Johnston proposed a hearty vote of thanks to lady members of the Hamilton Literary Society for kindly providing the refreshments, which would be served at the close of the meeting, and this was passed with acclamation.

The proceedings then terminated, and those present adjourned to the main hall of the Museum building, where the ladies of the society already named very nicely served refreshments.

## MAY 14th, 1907.

A meeting of the Royal Society was held on May 14 at the Tasmanian Museum. His Excellency Sir Gerald Strickland presided, and there was a large attendance of members and others. The chief interest of the meeting centred on a paper by Dr. F. Noetling on "The Stone Implements of the Tasmanian Aborigines"; but before the lecturer was called on to favour members with his views on this subject, some preliminary business was transacted.

Messrs. A. J. Taylor, L. Brownell, C. E. Webster, and the Rev. J. Heyer were elected members of the society.

The Acting Secretary (Mr. R. M. Johnston) read a circular which had been received through the Government Geologist (Mr. W. H. Twelvetrees), inviting the society to send a delegate to London to take part in the centenary celebrations of the Geological Society of London in September next.

Mr. A. O. Green suggested that Mr. R. M. Johnston be asked to undertake the representation of the society, and that the society should take steps to enable him to visit London for that purpose. Than Mr. Johnston no one was more capable of adequately representing Tasmanian science. He moved,—"That a deputation wait on the Government and obtain for Mr. Johnston permission to visit London for the purpose named."

Mr. A. G. Webster seconded the motion. Mr. Johnston, he thought, would be an admirable representative of the society, and would be greatly benefited by a rest from his arduous labours.

The motion was carried unanimously.

Sir Elliott Lewis suggested that the deputation should consist of the council of the society, or such members as it might appoint. He understood that Mr. Johnston was entitled under the Civil Service regulations to six months' leave of absence on full pay, or 12 months on half-pay.

Mr. Johnston thanked the society for the compliment which had been paid him. He would be only too pleased to represent the society in London; but it was questionable whether satisfactory arrangements could be made for his absence from his departmental duties for a period of six months. He would place himself in the hands of the society and of the Government.

## JUNE 11th, 1907.

monthly meeting of the Royal
was held at the Tasmanian
ı on Tuesday night. His Excel-
he Governor, Sir Gerald Strick-
resided.

cting-secretary (Mr. R. M. John-
ported that he had accepted the
ment as delegate to represent the
at the centenary of the London
al Society.

xcellency remarked that the so-
as fortunate in having such an
ty on geology as Mr. Johnston to
it it in London. They were in
to Mr. Johnston for having under-
o represent the society.

Johnston informed the meeting
e society had received an invita-
send a representative to Boston
part in the Zoological Congress
ıst. He added that he would be
to arrange his itinerary as to be
in Boston in August. Further,
ested that Mr. McNaghten, who
merly in Tasmania, and now at
l, might also be asked to repre-
society.

e motion of Mr. A. O. Green,
nston and Mr. McNaghten were
ed delegates to the Boston Con-

## ON THE BEN LOMOND PLAT-
## U, AND THE DISCOVERY OF
## H LAND AT THE NORTH
## D.*

. L. Piesse, B.Sc., read the fol-
paper by Colonel W. V. Legge,
., F.R.G.S., on the Ben Lomond
, and the discovery of the high
the north end.

ems desirable that the "Royal
Journal" should contain some
nary notes on my forthcoming
on the physiography of Ben
l for the meeting at Adelaide of
.A. Science, the principal object
paper being to give an ac-
of the discovery of higher
an the bluff or fell on which
rdnance survey trigonometri-
ion is situated. It is with this
herefore, that I have the plea-
submitting the following short
of the work done in March, 1906
mall expedition which I formed
examination of the plateau at the
nd. Little or nothing has been
scientifically of this part of Ben
l. It is never visited by tourists
too remote from the trig. sta-
ich is approached from the Avoca
n only. Hunters are said to oc-
lly ascend from the valley of the North Esk, and very rarely from the Mathinna country; but, on the whole, this area is as untrodden as the distant ranges of the West Coast.

The Ben Lomond Fell is a remarkable prominence in the escarpment of the southern end of the plateau, standing 200ft. above the surrounding crags, and has all the appearance, both from the low country and the adjacent "trough" valley and moor belts, lying to the north of it on the plateau, of being the highest part of the range. Hence, presumably, the reason that it was originally chosen as the position for a "pile" to connect the mountain with the triangulation to the west of it.

Looking north from the summit of this fell, the great moorland, which for the first five miles consists of generally level belts, seamed by long valleys, is seen to be divided by a deep transverse valley running from east to west, from a lofty upland, which rises near its centre to a north and south crest-line. A conspicuous hollow, passing to the north through this elevated track, gives additional prominence to it. The southern slopes of the hill, moreover, descend abruptly into the cross valley, and give this central group a generally elevated appearance. So marked is this that tourists viewing it from the trigonometrical station have often expressed the opinion that it was higher than the ground on which they stood. The strongest support, however, of this hypothesis has for many years been afforded to the writer by a study of the climatology of the pleateau and particularly the high north end in question from his home, near St. Mary's from which point of view the whole range is clearly seen.

The frequent cloud-capping of this tract prior to the advent of strong, and often damp, north -westerly winds, the southern end being, at the same time, free from all mist; earlier covering at the commencement of generally cloudy conditions throughout the district; heavy snowfalls in this part when the south of the plateau is almost free from a white mantle; and, finally, a much longer duration of snow during the general spring melting—have all tended for years to convince the writer that the north end is the higher area of the great mountain.

Hence the formation of a project after the conclusion of the congress of

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[ * Submitted for reading at the meeting in November last, when Professor Baldwin Spencer gave his lecture, but withdrawn by the writer, as no local matter was considered at that function. The paper is now re-submitted, as the treatise on the Ben Lomond Plateau, read at Adelaide, is not yet published.]

the A.A.A. of Science at Dunedin to carry out an exploration of the entire plateau, investigate the physiography of the moorland. and make a compass, or plane-table, topographical survey of its area. The easiest approach to the summit from the eastern districts being by way of Mangana, it was decided to carry out the work from that side. A thermometrical station for finding maximum and minimum temperatures was established on the moorland, at the rear of the south-eastern corner of the escarpment during the month of September, 1905, and in January, 1906, a base for triangulation of the southern area was laid out with the help of Mr. D. Macleod, of Mangana, on a flat part of the moor contiguous to the station. A survey of a portion of the south-eastern area followed, accompanied by an examination of the interesting flora of this alpine region, in which the hardy *Richea*, *Orite* *Olearia* and other alpine shrubs play a conspicuous part. An examination of the lake system with the watershed drained by the tarns, or lakes, was made, which demonstrated the incorrect position of the same as shown on the existing maps, in which only one is marked lying near the centre of the moorland. In point of fact, there are three sheets of water in the Nile valley, the so-called Youl's lakes, and another tarn, larger in area than any of the above, situated close to the eastern face of the plateau, and possessing no properly recognised name. This lake is fed by small runnels from the hills or tors which flank it; and at its head by similar sources rising in springs about 800 yards from the shore. About the same distance from these springs, in the opposite direction, the divide, which is quite level in the interval, sends its drainage by a small brooklet down a sloping vale, and through a gorge in the escarpment to the foothills above Mangana. This creek, therefore, is the most alpine source of the so-called "Tower Hill" rivulet, which drains the valley of Mangana into the South Esk.

It may be mentioned here that the summits of the lofty crags, forming the south-eastern mural boundary of the Ben Lomond range do not attain anywhere a greater altitude than 4,500ft., although they have the appearance, from the low country in the eastern districts, of being almost as high as the fell on which the trigonometrical station is situated.

To continue the work, and explore the northern area of the moorland, a small expedition was formed by the writer in March, 1906, to ascend the mountain by the new track made by the Fingal Road Trust from Mangana, and towards which the Premier kindly had a sum of £50 added to what was collected in the district. I was fortunate enough to enlist the services of Mr. Lyndhurst Gibli
known as an explorer and mount
the Government Analyst (Mr.
and his brother completing the
We left Mangana early on the
of March 29, and took the ne
which is an excellent one, afte
mounting the spur, leading up
Trotter's Valley, all the way to t
of the talus slopes, which descen
the escarpment on all sides
plateau. Thence for 900ft., or m
through the gap in the cliffs to t
of the moorland, it is very ste
when slightly improved will ma
ascent of no difficulty. Our c
ground was selected under the
of some erect diabase columns
from the creek above-mentioned,
was named the Mackenzie Rivul
noon on the following day all bagg
stores had been "swagged" up t
track from our temporary depot
The clearing-off and uprooting of
tensely rigid-branched alpine
*Orites*, *Olearia*, and *Leptospernum*
tain ti-tree), is no mean unde
without good axes, and thus the
tion of a camp site was a little
The elevation of it was 4,300ft.,
nights were so mild that we sle
fortably with an open tent-front

The first two days were spent
ther exploration of the southern
of the moorland, tracing the
courses, and surveying the upp
and its surroundings. The thi
(Saturday) was fixed for the tri
north, but we were fog-bound
the whole of it, and we
the undertaking till the
day following, deeming it a
to carefully set our aneroids at
station, with the camp as a stati
before visiting the high land bey
dividing valley. We were favour
a steady "glass" on the Sunday,
the afternoon made a trip to t
station. The official height, 5,01
found to be 112ft. above that g
the barometer, this being proba
to "lag" of the aneroid during
days, and to the smaller divisio
feet scale at the height from w
started 4,300ft. On the return
at 6 p.m., the "reading" was as
We had a steady barometer on
lowing morning, and took caref
ings before starting. Thus, the d
in altitude between the camp
heights ascended that day would
portionate to those observed on
to the station on the previous

Our track lay over the high
moor belt, and across two of th
teristic "trough" valleys, wh
minutely described in my treatis
mountain. On the floor of thes
covered three picturesque, but
tarns discharging southward, as

sequently ascertained, into the Nile system. It is noteworthy that all the tarns, or pools, on the plateau are shallow, owing to the floor of the valleys consisting of diabase boulders, lying immediately beneath the vegetation, their interstices and irregularities being filled with plant-humus and the rock-weathering of countless ages, on which the alpine vegetation thrives; consequently, the depressions which happen to hold the drainage from springs around them must of necessity be shallow.

On crossing the head of the dividing valley near its eastern outlet the country rose gradually to the group of hills in the centre of the moorland, noticed above, and which the writer named the "Giblin Fells." We passed up a talus-floored valley till a low water-parting was reached at the back of the great precipices overlooking the Tyne valley, and which was named "Ossian's Throne." Here is situated another tarn, fed by springs from the Giblin Fells, which has scarcely any outlet, but the drainage from which, in wet weather and at the time of the snow melting, naturally forms a burn running to the north. This receives streamlets on its left bank from the high fells, and develops into a creek issuing through a deep gorge towards the Rose's Tier divide, and flowing either into the Ford River or the Tyne, becoming, therefore, the true alpine source of either the North or the South Esk.

In this vale, which is well clothed with poa and other grasses, a halt was made for lunch, and the spot named "Meadow vale." The height of Ossian's Throne was found by aneroid to be approximately 4,900ft., the successive eminences of the escarpment all round to the north being, apparently, on a level with it, and consequently all higher than the southern bluffs of the mural boundary.

In the afternoon an ascent of the hills was made by Mr. Giblin and the writer, the former proceeding to what appeared the highest ridge, and the latter taking a lower crestline for investigation. At a point further north than our resting-place two depressions pass into this central group of hills from Meadow valley to the west, and divide the high land into two ridges, the northernmost of which is the higher. Down these hollows the little tributaries of the aforementioned creek descend, rising in springs, which are, perhaps, the highest in all Tasmania. Much grass, and an absence of the thick clothing of alpine bushes met with over the southern area, are noticeable in ascending these vales. At the foot of the higher ridge ascended by Mr. Giblin, the diabase formation crops out in columnar masses facing Meadow Vale, at the foot of which, as is seen all over the plateau, are small fields of talus descending to the main valley.

The summit of the ridge, which is reached in about three-quarters of a mile from its foot, is composed of rocky knolls or tors, flanked by slopes of talus, below which, as Mr. Giblin reported, the sides of the hill were grassy. The ridge ascended by myself was very rugged, broken on its crest into small, though precipitous, tors, with intervening areas of very rough talus. The ascent of this ridge took approximately, the same time as occupied by Mr. Giblin in surmounting the ridge to the north, which was made by aneroid reading to be about 50ft. higher. On his return from his climb he reported his reading to be 160ft. plus or minus 40ft. higher than that given by the ascent of the trig. station the previous day.

As a good view of the northern end of the plateau was obtained from Mr. Giblin's position, he found that the escarpment there was as high, if not higher, than the point, Ossian's Throne, mentioned above, and that the north-western corner consisted of a tableland holding some pools, or tarns, within its area. The stream passing down Meadow Vale was found, as already stated, to issue through a deep gorge to the north. The high group of fells (the name given, as above quoted, to this highland was in memory of Mr. Giblin's father, the judge, and in honour to himself as making the chief ascent of the day) occupies the major part of the northern area, which is, on the whole, different from the southern one in topographical features. The general conformation, conforming to a higher level, and the valley running north and flanking the group on the west, precludes the existence of the shallow trough valleys characteristic of the southern division of the moorland. Further explorations will probably discover interesting features* in the physiography of this little known tract of the great plateau.

Mr. Piesse also read a paper by Mr. L. F. Giblin, B.A., and himself on "The Height of Mount Legge (the name suggested for the tor forming the summit of the Giblin Fells at the northern end of Ben Lomond), with remarks on the Trigonometrical Survey of Tasmania."

### Discussion.

Mr. A. O. Green, Mr. Johnston, and Dr. Noetling offered a few observations on the foregoing papers.

On the motion of Mr. Green, seconded by Mr. B. Shaw, it was decided to ask the Minister of Lands to adopt the name of Mount Legge for the northern peak of Ben Lomond.

### Opsonic Index.

Mr. Johnston read a paper by Dr. E. J. Roberts on "The Germ as a Friend in Therapeutics" (Opsonic Index.) The paper dealt largely with the investigations which have been made for the purpose of determining what might be called the strength of an antitoxin for combating an infectious disease as it occurs in a particular patient.

Dr. Elkington, the Chief Health Officer favoured the society with some remarks on Dr. Roberts's paper.

## THE BEN LOMOND RANGE.

## NOTE ON THE HEIGHT OF LEGGE TOR.

(By Messrs. L. F. Giblin, B.A., and E. L. Piesse, B.Sc., read June 11, 1907.)

During two visits to the Ben Lomond Range in March, 1906, and March, 1907, we made some observations of the height of the northern part of the range, which we wish to bring to the notice of the society. On both occasions our parties were under the guidance of Colonel Legge, who has frequently visited the range, and who has given a full description of it in a paper read at the last meeting of the Australasian Association for the Advancement of Science. It was at his suggestion that we made the observations we now describe.

The most conspicuous feature of the Ben Lomond Range is the south-western summit, surrounded on two sides by high diabase cliffs, which is seen from the main line railway for many miles. On this summit is situated one of the stations of the Trigonometrical Survey of Tasmania made in 1851 and the following years. The maps of Tasmania based upon this survey show tht height of this station to be 5,010ft., and it has usually been thought to be the highest point of the range, and the highest point in Tasmania, with the sole exception of Cradle Mountain, which is stated on the maps to be 5,069ft. high. It should, however, be mentioned in discussing the heights of our highest mountains that no exact observations seem to have been made for the height of Barn Bluff, which is over 5,000ft.

Looking northwards from the
onometrical Station, the range is
extend for seven or eight miles,
width of three or four miles. A wi
deep valley, called by Colonel L
Dividing Valley, separates the
into two areas of noticeably di
character. The southern portion
be roughly described as a plateau,
sected by shallow and wide valleys
from 500 to 1,000 feet below the s
before mentioned, which rises out
plateau at its south-western corner
northern portion is much more
in appearance, and its average he
much greater than that of the so
half of the mountain. In the ce
the northern half, about one and
miles distant from the northern, e
and western escarpments of the
lies the summit which is the sub
this note. From the trigonom
station this summit appears to t
aided eye to be the highest point
mountain. Our observations were
to determine the difference of h
tween the trigonometrical stat
the northern summit. For this p
we used in the first instance an a
barometer, and subsequently we
ed a rough check from observation
an Abney level. We are aware
many sources of error incident t
use of aneroids, but the instrumen
was a good one, and most of the ob
tions were made in good conditions
we therefore think the results are
publishing.

The comparison of heights was m
three stages. In the first pla
found the height of Colonel Legge's
at Broken Bluff, at the south-easter
ner of the mountain, near Col. L
thermometrical station, and a sho
tance from the end of the track
Mangana. Taking the mean of a
ing and descending readings (which
method recommended by Mr. E
Whymper in his paper, "How to u
Aneroid Barometer"), and correcti
a fairly uniform change of pr
which was taking place during
day, we found that Broken
camp was 710 feet below the trigo
trical station. In 1906 the instr
used this year, and another instru
each gave 720 feet for this stage.
height of Broken Bluff camp is
fore about 4,300 feet—a result pro
correct within 20ft. or 30ft. unless
hidden source of error was prese
each occasion.

The next stage was from Broken
camp to a second camp at Meadow
a grassy valley in the northern p
of the range, four or five miles
Broken Bluff. From our observatio
March 16, we found that Meadow
was 400ft. above Broken Bluff. We

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* Mr. Giblin was good enough to name the tor crowning the high ridge of the fells he ascended Mount Legge, in honour of my leadership of the expedition to find the altitude of the northern area of the plateau.

the return journey on March 18, observing the barometer at short intervals for an hour to two before leaving Meadow Vale, and after reaching Broken Bluff. From these observations we computed the difference of height to be from 420ft. to 470ft., the uncertainty arising from our imperfect knowledge of the variations of pressure due to atmospheric changes during the day. Combining all the observations on both days, we took Meadow Vale to be 430ft. above Broken Bluff. The height of Meadow Vale is therefore about 4,730ft., but this result, for the reason stated, is more uncertain than that for the first stage.

The third and final stage was from Meadow Vale to the highest point of the northern part of the mountain. The mean of closely agreeing ascending and descending readings gave a difference of height of 440ft. The northern summit therefore appears to be about 870ft. above Broken Bluff. In 1906, with another instrument, the mean of ascending and descending readings taken on the same day between Broken Bluff and the northern summit was 860ft. Adding this number to the height of Broken Bluff, 4,300ft., we find that the height of the northern summit is in round figures about 5,150ft. If this result be correct, the northern summit is therefore about 150ft. higher than the trigonometrical station at the south-western corner of the mountain, and about 70ft. higher than Cradle Mountain, and therefore appears to be the highest known point in Tasmania.

This result cannot, however, be accepted as final. In spite of the close agreement between the observations made in 1906 and those of 1907, we cannot be quite certain that there are no hidden sources of error which might vitiate the result. Such errors are of two classes—the first, those due to the necessary imperfections of the aneroid as a means of measuring pressure, the second those due to diurnal and irregular atmospheric changes of pressure taking place whilst we were going from one point of observation to another. Of the first class the phenomenon of elastic fatigue, also known as "lag" or "hysteresis" is the most usual source of error. For such small differences of altitude as we were measuring, this is not very great, and we took sufficient readings to eliminate it. There are, however, other sources of uncertainty, such as change of index error, against which we could take no precaution. Of the second class of errors the uncertainty due to irregular atmospheric changes may affect the second stage of our work, but not, we think, the first and third stages. As to the regular diurnal changes we have no information which will enable us to supply a satisfactory correction.

As a check upon the determination by aneroid, we took an altitude observation with an Abney level. From the northern summit the trigonometrical station had a depression of about three-quarters of a degree. The distance apart of the two points is from six to seven miles. After allowing for a possible observational error of from 20 minutes to half a degree, we find that the northern summit is at the least from 100ft. to 200ft. above the trigonometrical station, so that its height appears from the Abney level observation to lie between 5,100ft. and 5,200ft.

We hope to be able next summer to make a small triangulation on top of the range, and so determine within a foot or two the difference of height of the two summits. We think it well, however, to place on record at once the results of our preliminary work.

The question may be raised: If, as our observations suggest, the northern summit is the highest point on the range, and probably the highest point in Tasmnaia, why is not this fact recorded on the maps compiled from the trigonometrical survey of the island? Such records as there are of the work of this survey are not in a condition to be readily intelligible to a casual inquirer, but we understand that they do not contain any observations of the northern summit. Several reasons, however, suggest themselves why it was unlikely that any observations of it should be made, even if, as was doubtless the case, its great height was noticed. The station on Ben Lomond formed part of the principal network of triangles which connected the base at Ralph's Bay with the base of verification at Longford, and which was the basis of the secondary triangulation from which the maps of Tasmania are compiled. When the principal triangulation had been extended northwards as far as Miller's Bluff (on the Great Western Mountains), and Mount Connection (on the Eastern Tiers midway between Ross and Swansea), it was necessary to choose a third point to the north, which with these two points would form a well-conditioned triangle. It so happens that the present trigonometrical station forms a triangle which is very nearly equilateral, and, is, therefore, well suited to be a part of the principal triangulation. If the northern summit of the Ben Lomond range had been chosen, the triangle formed by it with the two mountains mentioned would not have had quite such a good shape, and it would probably have been found that Mount Connection was invisible from it. Further, in choosing the principal stations of the survey, regard was doubtless had to their subsequent usefulness in land surveying. The present trigonometrical station was clearly the better for this purpose, for it is a conspicuous object from the valleys of the South Esk, the Macquarie, the Lake, and the Meander Rivers, all of which valleys were then settled. The northern summit, on the other hand, even where it can be seen, is not a good object from these valleys, and would have been useful only for surveys of the country to the north and north-east, which was then an almost untrodden wilderness. The absence, therefore, of any mention of this northern summit from the records of the trigonometrical survey is no evidence against its being the highest point of the range.

In making a more careful determination of the height of this northern summit in the way we propose, some examination is required of the meaning and accuracy of the statement on the map that the height of the trigonometrical station on Ben Lomond is 5,010ft. Postponing for a moment the doubt as to the precise point in space to which this statement relates, it may be said that there is little doubt that it represents the results of observations and calculations of very high accuracy. The general accuracy of the trigonometrical survey of Tasmania may be gauged from the fact (recorded in Major Cotton's paper on the survey, read before this society in 1854), (1) that when the base of verification, about five miles in length, near Longford, was measured, it was found that the difference between the measured length and that computed through thirteen triangles from the original base at Ralph's Bay, was only 3½in. —a result which so much astonished Sir William Denison, then Governor of Tasmania, that he checked the whole of the computations for himself, and found them quite accurate. It is true that the accuracy of this survey was impugned by a later Surveyor-General, and the maps drawn from it have been the subject of much criticism, but it seems safe to adopt the view of Mr. T. F. Furber, Director of the trigonometrical survey of New South Wales, contained in his paper on trigonometrical surveys, read before the Australasian Association for the advancement of Science in 1898 (2), that the observations and calculations were made with accuracy. The same cannot be said of the maps of Tasmania, for the rude sketches issued by the Department of Lands and Surveys are a disgrace to the colony. No blame can attach to this department for its inability to map those parts of the country, which are still unsurveyed and practically unexplored, but it is surely an example of our proverbial sleepiness that for so many years no improvements have been made in the mapping of districts which have been settled for nearly a century. In the representations of the mountain systems the maps are particularly defective. The system of hatching used to represent heights is not a good one, mountain ranges are frequently shown as rows of isolated and unconnected peaks, rising out of plains, and no attempt is made to depict plateaus and highlands. In the preparation of the latest map of Tasmania, published about 25 years ago, the use of contour lines was proposed, but this intention was abandoned, and the method of representing mountains actually used is inadequate and misleading. The ignorance of the topography of the island which is so common among us, is a direct result of the defects of the maps. The new map showing in colours the height of the different portions of Tasmania which the Director of Education is now having prepared for use in the State schools, may at last enable us to get a clear view of the vertical relief of Tasmania, which, as one of the determining causes of the distribution of human activities and of other phenomena, is a central feature of the geography of this as of other countries.

Returning to the trigonometrical survey, it appears that the system of marking the stations was not an accurate one, although the observations fixed the positions of the stations to a few inches. Usually an irregular cairn of stones was erected, presumably over the spot where the instrument was set up, and in this a wooden pole was inserted. It is usual in surveys of this kind to mark the exact position over which the instrument is set up by a metal plug set up in the solid rock, but this does not seem to have been done in Tasmania. (3) On Ben Lomond, a four-sided yard (locally known as the "Stockade") was built of logs carried up by prison labour from the forests below, and inside this there are remains of a small stone cairn. But in the lapse of 50 years, both yard and cairn have almost disappeared, and the horizontal and vertical position of the point of observation are now uncertain to some feet.

Whether or not the northern summit of Ben Lomond be the highest point in Tasmania, or the highest point of the range, it should have a name. The name Ben Lomond is commonly applied to the whole range, but is particularly associated with the south-western summit on which is the trigonometrical station. Between this and the northern summit there lies, as has already been stated, a deep valley, and it is, therefore, in accordance with the usual practice in such matters that the summits should be distinguished by separate names. For the northern summit we now invite the Royal Society of Tasmania, one of the leading objects of which is stated in its Constitution t be the investigation of "the Physic

Character of the Island," to adopt the name of Mount Legge (4), in honour of Colonel W. V. Legge, R.A., of Cullenswood House, Cullenswood, one of the vice-presidents of the society, and the president of the Council of Agriculture, who by his papers read before this society and before the Australasian Association for the Advancement of Science, has largely increased our knowledge of the physical features of the mountain systems of Tasmania, and particularly of Ben Lomond.

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(1) Cotton: The Trigonometrical Survey of Van Diemen's Land (Proc. Roy. Soc. Tas., vol. 3, p. 82).

(2) Report A.A.A.S., vol. vii., 1898, p. 176.

(3) See Report of the Select Committee on the Trignometrical Survey, 1857 (Journals of the Legislative Council, Vol. II., 1857, Paper No. 32).

(4) Note added July, 1907—The name "Legge Tor" has been adopted by the Department of Lands and Surveys for the northern summit.

# THE GERM AS A FRIEND IN THERAPEUTICS.

## (NOTES ON THE OPSONIC INDEX.)

(BY EDW. J. ROBERTS, M.B.)

During the last decade, the rapid strides made in surgery are well-known to the general public. It may be that the attention is so centred on that branch of the "Art of Healing" that, in a measure, the researches in medicine have not called forth the notice which they certainly deserve. The important question of immunity is now attracting the attention of the whole medical world, brought to its notice by the workers in hæmatology and bacteriology. In all cases where the unwelcome germ takes a part, the physician and bacteriologist must work together. The busy physician has not the time to complete his investigations of his case further than the clinical aspect of it, nor has he the laboratory, instruments, etc., necessary to the close study of the action of the germs causing that particular disease which he has under his care. The bacteriologist now informs the physician that there is a process by which one is able to pick out the defensive factors of the body, and to estimate their power of destruction over the investing bacilli. Although the process may not be taken over by the physician, yet, with the help of the bacteriologist, he is able to more clearly understand his patient's vital condition. We are indebted to Metchnikoff for pointing out some peculiar properties of certain white corpuscles, or leucocytes in the blood of man. These leucocytes have the power of absorbing or destroying the germs of disease under certain conditions, and it is pointed out that these conditions can be so altered as to effect the destroying property of the leucocytes. These leucocytes, or white corpuscles, are called phagocytes, and the process by which they absorb the bacilli is named phagocytosis. The blood serum has been found to contain certain substances or elements, to which the name "Opsonins" was given—this word "opsonin" is from the Latin verb "opsono," meaning I cater, or prepare. Therefore, the opsonins in the serum prepare the germs in such a manner as to render them an easy prey to the phagocytes. It is supposed, and it is probably the case, that the opsonins act by chemically uniting with the bacilli, so enabling the phagocytes to render them inert. In 1902, Major Leishman published in the "British Medical Journal" an account of a practical method whereby one can estimate the phagocytic power of the white corpuscles of the blood, and in following years Wright and Douglas also wrote. This year, Dr. McFarland and his confreres of Philadelphia published to my mind a much simpler process, which almost brings it usage into the hands of the physician. I will now come to the practical point of estimating the phagocytic power of the leucocytes. To quote Dr. McFarland: "In order to perform the experiment it is necessary to have first the living phagocytic cells; and, secondly, the bacteria they are to take up, and it is necessary to bring these two in contact under invariable conditions, in order that correct deductions concerning their interaction may be drawn." Now, first to secure the cells. Make a small puncture in the finger of the patient at the root of the finger nail, draw a small quantity of the blood that flows in a pipett, made for the purpose, or a capillary tube with even calibre. To prevent coagulation draw up in the same pipett an exactly equal quantity of a solution of citrate of sodium, 1½ per cent. Now blow both fluids on a clean slide, or better, in the depression of the slide. Draw up and blow out several times, until the fluids are thoroughly mixed. Now the blood is ready for the particular germ you wish to experiment with. Now, an exactly similar quantity (as the blood) of a standard emulsion of the bacteria is thoroughly mixed with the solution of blood and citrate of sodium. This mixture of blood, emulsion, and citrate solution is drawn up in a capillary tube, the ends sealed, and the tube placed in an incubator for thirty minutes. The tube is now removed from the incubator, the ends broken off, and the contents spread on a clean slide, and allowed to dry. The smear is then stained and counter-stained, dried, and mounted in the usual manner. The field should show the polymorpho nuclear neutrophiles with their nuclei and the bacilli stained according to staining method used. The phagocytes are counted, and the number of bacilli in each also counted, and the average taken. This number gives you the phagocytic index, and, dividing their number by the standard you have chosen, you get the Opsonic Index. This method, I hold, is a much simpler one than that of Wright and Douglas. Wright and Douglas separate the corpuscles with a centrifuge, wash the corpuscles, and use patient's serum. Now, one may well ask, What is the use and value of finding the opsonic index? It is to estimate the amount of the particular vaccine required to increase the patient's opsonic index, thereby increasing his power to resist attacks of bacilli. If the experiment is carried to a successful issue, and if the bacteriologist can place in the hands of the physician a simple workable test, there is no doubt that Pasteur's hope will come to be a fact. Pasteur prophesied that in time to come all infectious diseases would be treated and cured by vaccination, and when we review the past twelve years, we cannot but be convinced that this will be our method in the near future. I may here briefly describe the method of obtaining the vaccines. The vaccine consists of an emulsion of the particular germ which causes the disease which one is treating. Large growths of young cultures are grown on a medium, principally Agar, and when ready are washed off the agar with warm salt solution. This is now thoroughly shaken up in a test tube to separate the bacilli and to break down the clumps. A centrifuge does the work of separating very quickly; it is a very tedious process to get the emulsion to the proper standard. By comparing the number of red corpuscles with a number of germs in a given quantity of fluid, one can estimate the number of germs very readily. Take a mixture of one part emulsion, one part blood, and three-parts saline solution, and count both corpuscles and germs in a given space. Therefore, supposing there were ten times the number of germs as there were corpuscles, we should have 45,000,000 in one cubic millimetre. Now we come to the method of applying the treatment. First of all, you diagnose the disease, take the opsonic index of your patient, and have your vaccine. The patient is now given his injection of warm vaccine, and his opsonic index watched very carefully. A short time after the injection the opsonic index falls, and this stage is called the "negative phase." After a time, from a few hours to two or three days, the opsonic index rises again, and this stage is called the "positive phase." In time the index diminishes, and another injection is required, but this time the "negative phase" should be much shorter than the first. Then, again, the index rises, and may reach or even go higher than the normal. Repeat the injection until the opsonic index remains at the normal. Never give the vaccine during the "negative phase." What goes on in the patient during this treatment is, first, the opsonins are increased and the phagocytosis is improved, and, secondly, the bacilli are destroyed, and the infection ceases, and a cure is recorded There is no doubt whatever that performing the experiment is not so easy as one would imagine from merely reading an account of it. The difficulty of standardising the emulsion and the grinding and separating the bacilli require a lot of practice and care. The decalcifying the blood and the mixing of the fluids is simple enough, but it is rather a delicate and difficult job to fix and stain the smear satisfactorily. "Opsonin" is the sauce which is mixed with the bacteria to increase the appetite of the phagocytes. I mentioned immunity in the beginning of these notes. Immunity is really the power of resisting the attacks of any given germ or disease. This immunity may be either natural or may be produced by artificial means. To render my meaning more clear, I will take the disease small-pox, of which we have had quite enough experience in this State Some persons were naturally immune against this disease, while others readily fell victims to the small-pox bacilli To prevent the spread of this disease, we artificially rendered people immune by giving them the disease in a very mild form by vaccination. It was not actually the mild disease which we introduce that caused the immunity, but the products of bacterial action formed during its course. So, by these bacterial products, are produced various degrees of immunity without causing any disturbance to the patient in the majority of cases. Of course, an attack of the disease small-pox itself causes a much higher degree of immunity, and is more lasting than that caused by vaccination. It has been discovered that the serum of a highly-immunised animal when injected into a second animal will protect that second animal more or less from an attack of the given bacteria. Now, this serum from the highly-immunised animal is called anti-toxin, and one particular anti-toxin was used only recently in the slight outbreak of diphtheria in this city. Although all the sera have not been so successful as the anti-toxin of diphtheria, yet still I am certain, as the researches continue, we may be sanguine that they will be so. With reference to the phagocytic action of the leucocytes, we endeavour to increase that action by the injection of the bacterial products of the given germ. Let us take a case of consumption or tuberculosis—unhappily, we have not far to go for examples would it not be a blessing to all if we could destroy the tubercle bacilli by increasing the phagocytic power of the leucocytes by the simple means of injections of a serum? The delicate and most interesting process of finding the opsonic index, which I have endeavoured to explain to you to-night, may be hailed as another fighting factor against the dreadful disease tuberculosis. What physician would dare neglect to give the anti-toxin of diphtheria in a case of diphtheria at the present time if it were procurable? The same question will be asked in the future concerning other anti-toxins. The discovery of the phagocytic power of the leucocytes has caused workers all over the world to endeavour to make the test simple, and give a practical therapeutic value to it. I trust these few remarks will be understood, so that the public will be prepared in some measure for the practical working of this new curative agency.

## JULY 8th, 1907.

The monthly meeting of the Royal Society of Tasmania was held in the Society's rooms last evening. His Excellency the Governor, Sir Gerald Strickland, who was accompanied by the Lady Edeline, presided. There was a fair attendance of members.

The acting secretary (Mrs. Morton) stated that Professor Klaatch, who was here in January last, had forwarded casts of two skulls—Neanderthal skull and skull from Java, Pittecanthropus erectus.

Mr. A. J. Taylor made some interesting remarks upon the casts, and said they formed the most interesting objects ever presented to the ethnological branch of the Society.

### A Seismographic Observatory.

A letter was received from the Premier (Hon. J. W. Evans, C.M.G.), inviting the opinion of the Society on a resolution passed by the Australasian Association of Science that a seismograph station should be established at Hobart.

Mr. A. O. Green pointed out the value of seismograph observations, and moved a resolution in support of the opinion of the Australasian Association of Science that a station should be established in Hobart.

Dr. Noetling seconded the motion, and gave the causes of earthquakes, and pointed out the improbability of such occurring in Tasmania.

Mr. Piesse supported the motion, and spoke of the scientific value of such observations.

The motion was agreed to.

### The Northern Territory.

Senator Dobson, who recently contributed a series of articles to "The Mercury" on his visit to the Northern Territory, next gave members some particulars of his trip and observations. He remarked that the area of the country was 335,116,000 acres, which Mr. Deakin had agreed to take over, subject to the approval of the South Australian and Federal Parliaments. It was proposed that they should take over its debt, amounting to £3,217,500, purchase the Port Augusta railway at cost price, £2,318,242, and which was losing £80,000 annually. The train ran once a fortnight. Proceeding to describe the country, Senator Dobson said it seemed to be a desert. Over the whole of the Northern Territory it was impossible to see tropical vegetation. Tropical Australia seemed to him to be unlike almost every other tropical country, there being an absence of indigenous tropical vegetation, and he was sorry to say no experiment had been made by the South Australian Government as to whether any cultivation of tropical plants could be carried on with profit. He had seen a grove of cocoanuts in the course of his travels, which had been introduced there, but almost every tree had been burrowed out by white ants, and the trees were slowly dying. Orange and lemon trees suffered the same way. He believed, from the information he gathered, that cotton could be grown there, as well as tobacco. The cattle breeding industry had, he believed, been a success, but the country leased to the breeders was something enormous, because it was necessary that they should have access to water in the event of droughts. One man, he was told, bred 14,000 calves the year before last. One breeder had a lease of 9,000 square miles. He was informed that horses could be bred there, but the specimens which he saw did not confirm that statement. Speaking of his visit to the Adelaide River, Senator Dobson said there were 60 miles of marsh land on either side, and if properly treated and drained it might grow rice or anything else that could be grown in the tropics. Tropical agriculture had not as yet had a commencement. He proceeded to explain how difficult it would be to carry this on, owing to the labour question. Labour would have to be imported from India to cultivate jute for instance, and the industry would have to bear the cost of the importation, the repatriation at the end of a term, and compete with the industry carried on under natural conditions in India. He was told that in India two million acres were kept in cultivation for the jute plant. How could we compete with them? As to the route the proposed railway should take, Senator Dobson took exception to being bound down by the agreement made with South Australia as to any particular route being chosen. In connection with this matter, the question of defence would be found to be closely interwoven with it, and he was not prepared to vote for any agreement that tied their hands to any one direction. He looked to the time when the mails from England would come across the Continent of Europe through Turkey and Persia, through Northern India, down to the Malay Penisula by Singapore, when they would be within four days' steam of Port Darwin. Senator Dobson next had something to say about Australian defence, and said before they built any railway there ought to be the strictest inquiry by naval and military experts. The taking over of the Northern Territory involved many difficult problems, and it would take months of debate.

A discussion ensued, and His Excellency, after offering some remarks on the discussion which had taken place, moved a vote of thanks to Senator Dobson for his address.

## AUGUST 14th, 1907.

# COLLISIONS AT SEA.

## HOW THEY ARE CAUSED.

## "HARD A-PORT; FULL SPEED ASTERN."

A meeting of the Royal Society of Tasmania was held on August 14. Mr. Bernard Shaw, I.S.O., presided over a gathering which scarcely numbered a score, owing to the meeting clashing with other functions taking place in the city that evening. His Excellency the Governor sent a letter of apology for his non-attendance.

Mr. W. F. Ward read a paper upon "The effect of reversing the screw on the steering qualities of a ship, with an explanation of the Togo-Alice collision." He feared that neither the navy nor the mercantile marine had yet assimilated the vital facts bearing on collisions with which he dealt. If this opinion were wrong its expression could do no harm; if right, much good should result. He began with an illustration. One night in April last, when the steamer Togo was going down the River Tamar, and the yacht Alice was steaming towards her, both going at full speed, the captain of the Togo judged that a collision was practically inevitable, and gave the orders "Hard a-port;" "Full speed astern." These were promptly carried out, the collision was duly brought about, and ten valuable lives were lost. The correctness of these orders had not been questioned, in or out of court, and it might be assumed, therefore, that they were generally regarded, even to this day, as safe and proper under similar circumstances of impending collision. He would submit, however, reasons for believing that these two orders combined, so far from making for safety, were, in their combined effect, the actual and direct cause of an otherwise avoidable collision. Not only this, but that, in similar circumstances, these orders were wrong in principle, that they have led to many collisions in the past, and unless discredited, would lead to more in the future.

These reasons were founded on actual experimental results obtained by a British Association committee, which consisted of Sir W. Thomson, F.R.S. (now [illegible]), Professor Osborne Reynolds, F.R.S., Mr. J. R. Napier, F.R.S., Mr. W. Froude, F.R.S.

[illegible] a series of experiments [illegible] by Professor Reynolds (report [illegible]) the committee reported (1876) as follows:—"The experiments of the committee on large ships have completely established the fact that the reversing of the screw of a vessel, with full way on, very much diminishes her steering power, and reverses what little it leaves, so that where a collision is imminent, to reverse the screw and use the rudder as if the ship would answer to it in the usual manner, is a certain way of bringing about the collision, and to judge from the accounts of collisions, this is precisely what is done in nine cases out of ten."

Further, the committee went on to report: "It appears that a ship will turn faster, and for an angle of 30deg., in less room when driving full speed ahead, than with her engines reversed, even if the rudder is rightly used. Thus when an obstacle is too near to admit of stopping the ship, then the only chance is to keep the engines on full speed ahead, and so to give the rudder an opportunity of doing its work."

The speaker illustrated his address with diagrams. The first showed approximately the effect of reversing the screw of one of the experimental vessels. The screw was reversed at a point called E, and the vessel was in position D at the time when she had lost half her way. Another point (C) showed the position reached in the same time when the screw was not reversed, the helm in each case being hard a-port. By the time she had lost all way this vessel was heading 30 degrees to port of her original direction, whereas had her screw not been reversed she would have headed 60 degrees to starboard, so that the total effect of reversing was to turn her through 90deg.

The committee, he stated, said: "A glance at the diagram is sufficient to show what a fatal mistake it must be, when a collision is imminent, to reverse the screw, and then use the rudder as if the ship would asnwer to it in the usual manner." A second diagram was a sketch applying these experimental results to fairly meet the evidence given at the inquest, although much of this was contradictory. The first point (A) suggested the position the Togo would have reached had her screw not been reversed; the second (B) her possible position owing to reversal; and the third (E) where her screw was reversed. The Alice was heading for the bank, and the Togo was shown striking her practically at right angles, as stated by her captain. That something like this must have taken place was supported by the fact of the collision occurring at right angles, for it was known that the vessels' helms were both hard a-port. If both were answering their helms properly it would appear that, if they struck at all, they would meet either almost bows on, or at an oblique and glancing angle. Here, then, was further support for the contention that, owing to the reversal of the screw, the Togo, instead of going to starboard and safety, as intended, actually went to port against her rudder, and so into collision. Counsel, at the inquest, several times asked in vain for an explanation of this remarkable position at right angles.

Variations due to differences in ships; to right or left-handed screws, and their effects with helms to port and to starboard; the steering effects produced by reversing from full speed astern to full speed ahead; and other important details, were given in the reports of the committee. The Admiralty, at the request of the committee, furnished details of trials made with two large ships, and these confirmed the committee's conclusions (B.A. report, 1880).

These results did not reach the committee for nearly 3½ years; it was possible that they have remained still practically unknown, and that some of the "numerous collisions between the ships of our own navy," mentioned by the committee as occurring while they were endeavouring "to execute ordinary movements," might still be repeating themselves, owing to unexpected alteration of direction, due to the reversal of screw reversing the rudder's action. Cable news had recently been received that eight destroyers had been damaged in a fortnight. Vessels of this class train in squadrons, sometimes at night, without any lights, and they ran, therefore, unusual risks of collision. They had, however, twin screws, but it seemed not improbable that in their case also some analogous effect of reversal would best explain vague statements as to failure to answer helm, or failure of steering gear to act at a critical moment..

In conclusion, he claimed that the importance of the subject justified bold argument from the particular to the general, and submitted that, at the very least, he had made out an overwhelming case for experimental trials with the Togo, as a first step towards ensuring public safety in the future.

Mr. A. O. Green contended that mariners were acquainted with the effect which the reversal of the screw had upon the steering qualities of ships. But to ask a captain to dash full speed ahead, relying only upon the action of his helm, was to ask him to undertake a very great risk. The approaching ship loomed up big in front of him, and the question was whether he would be able to clear the large arc on the horizon. If he went full speed ahead with a full helm and failed to clear the ship in front, the collision would be as bad as it could be. Yet he knew that while he reversed his engines, and was lessening the blow, he was, at the same time, more likely to incur a collision. But he knew further that if he did reverse his engines and gave the order "hard a-port," he was sure of obtaining greater consideration at the hands of the subsequent court of marine inquiry than would the captain who had determined to dash "foolhardily ahead."

Further points of detail were discussed.

Mr. Ward, in reply, said he realised that the idea had yet to be driven into the minds of courts of law. They should acknowledge that the man who drove ahead was in the right.

Mr. Ward was accorded a vote of thanks by the meeting for his paper.

## OCTOBER 14th, 1907.

The monthly meeting of the Royal Society was held at the Museum last evening. His Excellency the Governor, Sir Gerald Strickland, presided.

The following were elected members:—Rev. F. H. Baring, M.A., F.R.G.S., Dr. Lindsay Miller, Mr. M. Mason, and Alderman H. T. Gould.

### Tasmanian Emus.

The Secretary (Mrs. C. E. Morton) read an extract from "Nature," in reference to some bones of the small emu which were sent to Professor Giglioli, of the Royal Zoological Museum, Florence, they having been found by Mr. R. M. Johnston and the late Mr. Alex. Morton on King Island. Professor Giglioli stated that the bones were absolutely identical with the corresponding bones of Peron's specimen from Kangaroo Island. The same professor said:—"We possess two authentic skeletons and two mounted specimens of Dromæus ater (Peron), which, in the first years of last century, was abundant on Kangaroo Island; two of these four specimens are in Paris, one is in Florence, and one in Liverpool. Mine is a skeleton, and is one of the three brought alive to France by Peron in 1803 from Kangaroo Island. The Liverpool specimen is, I think,, not located; it is, undoubtedly, D. ater, but might hail from King Island, or even from Tasmania; it may be the 'lesser emu' of the Bullock Museum, dispersed in 1819."

### Electricity and Matter.

"Electricity and Matter" was the subject of a paper read by Mr. H. J. Spencer. He remarked upon the progress that had been made in the practical application of electricity, some thirty years ago there being no electrical industries in existence. In 1831, Faraday discovered the principle of the dynamo, but nearly forty years elapsed before that great discovery bore fruit. After referring to some of the uses of electricity, Mr. Spencer briefly touched upon the work of the earlier investigators, and described the phenomenon which led up to the electronic theory. Having taken his hearers step by step up to the problem of structure, he said, having reached the conclusion that electricity, like matter, was atomic in structure, were they prepared for the question, "Is electricity identical with matter?" He proceeded to discuss the subject, and concluded by pointing out that the free motion of electrons in a conductor created what was called an electric current; their vibration gave rise to ether waves or radiation, whether it be light or heat. The ether could only be moved by electrons, hence the electron appeared to be the source of all physical phenomena, and when they understood better how to control its motions, they might be able to produce light without heat; nay, further, perhaps to marshal these invisible servants without the aid of cumbersome machinery, and train them to do our will by far simpler and more efficient methods than we at present use. To substantiate the theory, it must be made to explain all the facts of chemical combination and volency as well, but to go into that would involve much more time than was at his disposal. The lecture was illustrated with several interesting experiments.

Mr. Spencer was asked several questions appertaining to the question by His Excellency, and made interesting replies.

Dr. J. S. C. Elkington spoke of the therapeutic value of electricity, and said they must all concur that Mr. Spencer had given them a most excellent and interesting address.

His Excellency, in proposing a vote of thanks to Mr. Spencer, said he had furnished them with a very rapid, useful, and concise demonstration of several of the recent commercial successes in the application of electricity. He had enabled them in a few minutes to realise what they could not understand from hours, and, perhaps, weeks, of book reading. He had enjoyed the evening's entertainment very much, and on behalf of himself and Fellows he tendered Mr. Spencer their cordial thanks. (Applause.)

# In Memoriam.

## THE LATE MR. ALEX. MORTON.

The news of the death of Mr. Alexander Morton, Director of the Tasmanian Museum, will be received with regret by the public of Tasmania, to whom his name has long been a household word, as also by scientific workers throughout Australia, by whom he was held in high esteem. Mr. Morton died shortly before noon on Monday, May 27, 1907, at Whitminster Lodge Private Hospital, Sandy Bay, near Hobart, Tasmania, of which he had been an inmate for some weeks. The immediate cause of death was heart disease.

Born at Hardtimes Landing, Louisiana, about fifty-two years ago, the son of a planter, Mr. Morton, while yet a boy, migrated with his father to Queensland. Morton senior invested what capital he possessed in a sugar plantation, but died before he had time to bring his enterprise to a successful issue. In consequence of his father's death, Alex. Morton, who was still young, was thrown entirely upon his own resources: he had to begin life at the foot of the ladder. For a time, in colloquial phrase, he roughed it; he gained a livelihood by the means he found most ready to hand, and at one period served as a seaman before the mast. Subsequently the experience gained in his younger days became invaluable to him; for it fitted him, as no other training could, for the missions which he was selected to undertake by the Council of the Sydney Museum and other scientific bodies. Having joined the staff of the Sydney Museum, he rose rapidly in the estimation of the Council, and of the Curator (Mr. Ramsay); and when it was decided to send an exploring party to New Guinea, to the remote parts of Queensland, and to the Andaman Islands, he was chosen for the work, and discharged his commission in a manner which gave general satisfaction. He visited places which had not previously been explored by a scientific collector, a fact which gives some of his records a unique value. In the course of time Mr. Morton came to hold a high position in the Sydney Museum, and when the directorship of the Tasmanian Museum became vacant, about 23 years ago, he offered himself for the post. The Royal Society, in view of his favourable recommendation by the authorities of the sister institution in New South Wales, unhesitatingly appointed him. That the Royal Society was exceptionally happy in its choice has long been universally admitted. The Tasmanian Museum in its present magnitude and completeness is of Mr. Morton's creation. He revised the classification of the collection of specimens which he found on taking charge of the institution; and not only did he revise it, but he added to and increased it very materially. His object was not merely to make the Museum a place where the curious might gratify a taste for novelty but a school for the instruction of both local people and visiting scientists. His scheme of classification enabled the inquirer to view the natural history of the whole island, as it were, in miniature. Besides being a Curator of all-round capacity, there were some departments of his work to which he devoted particular attention, and in which he achieved notable success. In ornithology and ichthyology he made original researches, and materially improved the collections of specimens illustrative of these branches of natural history. Mr. Morton did not profess to be a connoisseur of art, but with the means at his disposal he did his best to get together a collection of pictures worthy of the city. His success in securing works of art on loan was remarkable; indeed, he succeeded when no one else would think of making an attempt. As secretary of the Royal Society, he discharged his duties with the same abounding energy, and to him must be assigned in a large measure the credit of having maintained public interest in its discussions. And while he was ever ready to put his own shoulder to the wheel, he possessed in a rare degree the faculty of enlisting the services of all whom he thought capable of assisting. If an eminent scientist visited the city, the public never waited long to learn that Mr. Morton had induced him to give the Royal Society the benefit of his special knowledge. There was another institution, the Science Conference, in which Mr. Morton interested himself, and on behalf of which he worked with characteristic vigour. It benefited largely by it powers of organisation, and at critical times in its history he was largely instrumental in preserving its existence.

Reference has already been made to some of Mr. Morton's scientific expeditions. It remains to speak of one or two more. Some years ago he was commissioned by the Western Australian Government to make a collection of the minerals of that State. This he did in a manner at once successful and satisfactory to those concerned; and, thanks to the generosity of the Western Australian Government, the Tasmanian Museum was enriched by large additions to its geological departments. Another commission which he undertook and successfully performed was the importation of fish from Canada. During the Canadian winter he worked night and day, and it is not improbable that the over-exertion then undergone contributed to his breakdown in health. His activity was by no means confined to the Museum. He was Director of the Botanical Gardens, Secretary of the Domain Committee, and a member of the Fisheries Commission. In these several capacities he laboured with his wonted energy and ability. He was one of the oldest and most useful members of the Southern Tasmanian Agricultural Society, and assisted very materially in bringing that organisation up to its present prosperous condition. Other societies benefited by his industry and enthusiasm; in fact, wherever there was good work to be done for the public or for any scientific or benevolent object, there Mr. Morton was to be found, and in his own way always undertaking a large portion of the work.

Of Mr. Morton one who knew him intimately says:—"He was a warm and loyal friend. If a man was ill he would be willing to watch by his bed all night, even though he scarcely knew him. No man was more tender than he was, and of all the men I ever knew, none was more affectionate and loyal."

The deceased gentleman leaves a widow and family of three daughters and one son.

The interment of his mortal remains took place at the Cornelian Bay Cemetery on Wednesday, 29th ult. There was a large gathering of sorrowing friends.

The funeral of the late Mr. Alexander Morton, whose remains were buried in the cemetery at Cornelian Bay on the 29th May, 1907, was one of the most representative that has ever been witnessed in Hobart. The flags at the public and leading private offices, including those of the S.T.A. and P. Society, were at half-mast, out of respect to one who had done so much for the community among whom his lot was cast. For the deceased had not only been Director of the Museum for a great number of years, but had taken an interest in, and had been personally associated with, so many other institutions of a scientific and general character, each of which sent at least one representative to pay the last sad testimony of respect, that the gathering at the grave was typical of Hobart from almost every point of view. The beautifully ornamented coffin of polished wood, with silver decorations, was almost hidden beneath a mass of floral wreaths, mute symbols of a sympathy that was universally felt. There were wreaths "from his wife and family," from the nurses at Whitminster Lodge, who had soothed his last sad hours; from the Trustees of the Museum, also from Messrs. J. and L. Arnold, and Stanley, of the same institution; from Mr. A. G. Webster, chairman of the Royal Society, and another from the Council of the same; from Lebrena, Holebrook, the residence of the Webster family; from Mr. E. Hawson, chairman of the committee of the S.T.A. and P. Society; from Mr. R. M. Johnston, I.S.O., who had long been the deceased's particular friend; from Mr. J. Wardman, of the Botanic Gardens, of which the deceased had been the director; from Colonel Legge; from the president and members of the Hamilton Society; from the committee of the Arts and Crafts Society, in whose work the deceased took the greatest interest; from the W.M., officers, and brethren of the Tasmania Union Lodge; from the members of the Tasmanian Field Naturalists' Club, to which the deceased had rendered valuable assistance in many ways; from the Tourist Association; from Mr. G. A. Webster, M.B.; from Mr. W. P. Taylor and family; from "Marie, with love and deep sympathy;" and last, but assuredly not least, "from his little friend, Eric Waugh."

The funeral cortege left the Museum shortly after 2.30 p.m. There were a large number of carriages, the first containing the chief mourners — Master Morton, the deceased's only son, and Mr.

C. Westbrook, his son-in-law, with whom were Mr. A. G. Webster and Mr. R. M. Johnston, I.S.O. The Governor's carriage followed next, His Excellency being represented by Mr. George Browne, I.S.O., private secretary. The following gentlemen were also present: — The Acting Premier (Hon. W. B. Propsting, M.L.C.), and the Minister of Lands (Hon. Alec. Hean); the Speaker of the Assembly (Mr. J. G. Davies, C.M.G.), Messrs. A. G. Webster, Bernard Shaw, I.S.O.; R. M. Johnston, I.S.O., F.L.S.; Thos. Stephens, M.A., F.G.S.; Russell Young and Colonel W. V. Legge, R.A. (trustees of the Museum); Sir Elliott Lewis, K.C.M.G.; Judge Clark; Bishop Delany, and Revs. M. W. Gilleran and P. R. Hennebry; Canon Shoobridge (representing Bishop Mercer); Messrs. A. Reid (Under Treasurer), J. K. Reid (Clerk of the House of Assembly), who also represented the kirk session of St. Andrew's; and E. C. Nowell, I.S.O. (Clerk of the Legislative Council); Senator Mulcahy; the Mayor (Alderman C. D. Haywood) and Aldermen A. Crisp, G. Kerr, and H. T. Gould; the Solicitor-General (Mr. E. D. Dobbie); Hons. W. H. Burgess, Arthur Morrisby, M.L.C., and Stafford Bird, M.H.A.; Captain A. C. Parker (representing the Commandant); the Surveyor-General (Mr. E. A. Counsel); Rev. G. W. Sharp; Messrs. E. Hawson (chairman of committee), Leslie Murdoch (secretary), and members of the S.T.A. and P. Society; Mr. A. Wertheimer (secretary) and members of the Tourist Association; Mr. J. E. C. Lord (Commissioner of Police); Drs. E. L. Crowther, M.H.A., Gregory Sprott (City Health Officer), G. H. Butler, M.L.C., E. J. Crouch, E. W. J. Ireland, and A. H. Clarke; Mr. J. Wardman, Colonel Warner, etc.

The cortege drove up Elizabeth-street to the cemetery at Cornelian Bay, where the deceased's remains were laid to rest. The Rev. James Barr, of St. Andrew's Church, in accordance with the expressed desire of the deceased, conducted the funeral service, which was of the simplest character. The funeral arrangements were in the hands of Messrs. A. Clark and Son.

# Report of the Royal Society of Tasmania for the year 1907.

The Council of the Royal Society of Tasmania present to the Annual General Meeting of Members their Annual Report upon the operations of the Society during the year 1907.

Eight ordinary and three special general meetings of the Society were held.

The Members of the Council were engaged for some months on a revision of the Rules of the Society, which had become unsuited to the present conditions. The revised draft was approved and adopted at a special general meeting held on December 23rd, and the rules are now printed.

One of the new rules provides for the admission of Associates at a fee of 15/- per annum. Provision is made also for the establishment of sections for the study of particular branches of science, named as follows :—

Section A.—Natural History and Geology, including field excursions.

Section B.—Medical Science.

Section C.—Biology.

Section D.—Australasian History, Geography, and Ethnology.

Section B. has been in operation for some years, but is only now included in a general scheme.

Members of the Council and the Society deeply regret the death of their late Secretary, Mr. Alexander Morton, which took place in May last.

Early in July a Member of Council, Mr. R. M. Johnston, I.S.O., visited England and America to represent the Society and the Tasmanian Museum at a Zoological Conference in Boston, U.S.A., and at the Centenary Meeting of the Geological Society in London. Mr. Johnston was the bearer of a memorial from the Council on the occasion, conveying the greetings of the Society to their confrères in scientific work.

The membership of the Society has kept at about the level of the three previous years. Fourteen new Members were elected; seven were lost by death or resignation. It is hoped that with the new year an increase in membership and a greater number of scientific papers will widen the scope and strengthen the position of the Society. His Excellency the Governor, who is the President, has taken a great interest in the welfare of the Society, and whenever possible has presided at the monthly and special meetings.

One change has been made in the personnel of the Council. Professor Neil Smith having resigned his place has been filled by the election of Dr. J. S. C. Elkington.

# Statement of RECEIPTS and DISBURSEMENTS for the year 1907.

## RECEIPTS.

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| Balance from 1906 ... ... ... | | | | 8 | 16 | 2 |
| Subscriptions, including One Life Member ... ... ... ... | 158 | 10 | 0 | | | |
| Donations ... ... ... ... | 21 | 1 | 0 | | | |
| Sale of Book ... ... ... ... | 0 | 3 | 0 | | | |
| | | | | 179 | 14 | 0 |
| | | | | £188 | 10 | 2 |

## EXPENDITURE.

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| Salaries and Wages ... ... ... | 36 | 13 | 4 | | | |
| Messrs. Davies Bros. Ltd.—Printing | 50 | 0 | 0 | | | |
| Messrs. Walch & Sons ... ... ... | 45 | 16 | 9 | | | |
| Mr. E. Chancellor ... ... ... | 3 | 6 | 7 | | | |
| *Tasmanian News* ... ... ... | 4 | 7 | 6 | | | |
| Purchase of Books—Hood ... ... | 0 | 3 | 6 | | | |
| Furniture and Fittings ... ... | 9 | 14 | 9 | | | |
| Postage, Stamps, Petty Cash, etc. ... | 5 | 7 | 6 | | | |
| Mr. N. Oldham—Lantern ... ... | 5 | 0 | 0 | | | |
| Bank Charges, 10s.; do. Exchange, 9d. | 0 | 10 | 9 | | | |
| Grant to Medical Section ... ... | 12 | 0 | 0 | | | |
| | | | | 173 | 0 | 8 |
| Cr. Balance to 1908 ... ... ... | | | | 15 | 9 | 6 |
| | | | | £188 | 10 | 2 |

Liability—
Messrs. Davies Bros.—Printing, £28 6s. 3d.

## MORTON ALLPORT MEMORIAL FUND.

| | £ | s. | d. |
|---|---|---|---|
| Interest, Invested Fund ... ... .. ... | 9 | 5 | 0 |
| Dr. Balance to 1908 ... ... ... ... ... | 6 | 16 | 5 |
| | £16 | 1 | 5 |

| | £ | s. | d. |
|---|---|---|---|
| Messrs. Walch & Sons—Books ... ... ... | 3 | 11 | 5 |
| Messrs. Hood & Co.—Books ... ... ... | 2 | 0 | 0 |
| Messrs. Walker & Co.—Books ... ... ... | 10 | 10 | 0 |
| | £16 | 1 | 5 |

*Reconciliation of Bank Balance—*

| | £ | s. | d. |
|---|---|---|---|
| Cr. Royal Society Fund ... | £15 | 9 | 6 |
| Dr. Morton Allport Fund ... | 6 | 16 | 5 |
| Bank Balance, 31/12/07 ... | £8 | 13 | 1 |

I have this day audited the books of the Royal Society of Tasmania, and found them to be correct.

H. W. W. ECHLIN.

Hobart,
18th March, 1908.

*The following Papers were read during the winter season, 1907:*

April 29th.—"A Review of the Year's Topics of Scientific Interest."—His Excellency the Governor.

May 14th.—"The Stone Implements of Tasmanian Aborigines.'—Dr. F. Noetling.

June 11th.—1. "Note on the Ben Lomond Plateau and the Discovery of High Land at the North End."—Col. W. V. Legge, R.A.

2. "The Ben Lomond Range—The Height of Legge Tor."—Messrs. L. F. Giblin, B.A. and E. L. Piesse, B.Sc.

3. "The Germ as a Friend in Therapeutics.—The Opsonic Index."—Mr. E. J. Roberts, M. B.

July 8th—"The Northern Territory."—Senator Dobson.

August 14th.—"Collisions at Sea.—The effect of screw reversion.'—Mr. W. F. Ward.

October 14th.—"Electricity and Matter."—Mr. H. J. Spencer

# NOTES ON THE TASMANIAN AMORPHOLITHES.

(By Fritz Noetling, M.A., Ph. D., etc.)

## I. INTRODUCTION.

The application of the terms: Eolithic, Palæolithic, and even Neolithic to designate certain groups of stone implements, has of late become very erratic and uncertain. It would trangress the limits of this paper to discuss the causes of this vacillation, but it is sufficient to say that the so-called "biological" moment is a good deal responsible for this uncertainty. Tools and implements wrought by human hands, whether at the dawn of mankind, or in the heyday of our present civilisation are lifeless objects, and no matter of argument will ever instil them with life. These objects are the produce of a more or less advanced technical skill of their makers, and therefore the representatives of certain technical stages, which must not necessarily have existed simultaneously all over the earth. Form alone, unsupported by other evidence, is no proof of age, this we may take as granted, and all modern authors agree on this point. The best and safest way is therefore to divest the terms Eolithic, Palæolithic, and Neolithic of all connection with age, absolute or relative, and to consider them as terms merely used to express a certain stage of finish—in other words, to represent certain technical stages during the general evolution of human life. If applied in this restricted sense only, the above terms lose at once all their uncertainty, because it is easy enough to define the essential features of a given technical stage.

If we let the bewildering mass of relics which innumerable generations have left behind pass review, one fact becomes conspicuous at once. There is a large group of implements which leave no doubt that it was the intention, the will of their makers to produce a certain, well-defined form. These implements bearing evidence of the intention or will to produce a certain shape may be conveniently termed: Morpholithes. The other large group represents all those numerous, shapeless implements, which bear no evidence of the maker's will or intention to produce a definite shape. This group of implements may fitly be termed: Amorpholithes.

It will at once be seen that the Amorpholithes represent a lower technical stage than the Morpholithes, and that of necessity they are not so conspicuous objects as the latter. In fact, it is almost impossible to distinguish the lowest types of Amorpholithes, that is to say, objects wrought by human hands, from specimens accidentally produced by natural causes, unless we have some unshakable evidence in proof of their artificial nature. It is probably this difficulty, and the reluctance to express a definite opinion on an object which, after all, may only be a lusus naturæ, which accounts for the indifference, not to say contempt, with which this branch of the prehistoric science has generally been treated. Only quite recently the enormous importance which these rudely manufactured implements bear on the history of our race have been fully recognised, mainly thanks to the energetic and skilful work of the Belgian geologist, Rutot, in Bruxelles. Rutot termed those specimens which he found in the diluvial strata of Belgium, and of late, as he tells me by letter, even in beds of Miocene and Oligocene age: Eolithes. It is in my opinion unquestionable that this term is too widely circumscribed, and that among a larger number of Eolithes in the meaning of Rutot, we can, with the greatest ease, distinguish a certain number of specimens which are always characterised by two very different faces. One face is always flat, and, as proved by the bulb of percussion, unquestionably represents the plane of fracture when struck off from the parent block. This face never shows any traces of secondary trimming or chipping. Flatness was an essential feature of this face, and as we shall presently see this flatness was not accidental, resulting from the flaking off the implement from a larger block, but a feature that was desired, intended, to produce when the implement was manufactured. Quite different is the appearance of the opposite face; this is always convex, and always more or less worked or trimmed.

The name of Archæolithes has been suggested for this group of Amorpholithes, and though this term has not been generally accepted, yet the study of our Tasmanian Amorpholithes has convinced me that it fits admirably to the largest number of the specimens found in this island.

I therefore divide the Amorpholithes into two groups, viz:—Eolithes and Archæolithes. As Eolithes, I define all those Amorpholithes which show traces of use only, but no traces that they have been subjected to previous chipping or trimming. Eolithes are, in fact, the most primitive tools human beings ever used. Conveniently shaped pebbles picked up anywhere, sharp-edged pieces of rock, in Tasmania, handy pieces of columnar Diabas; in fact, any piece or fragment of stone that primitive man could use for his simple purposes, without previous dressing, constitutes an Eolithe.

As Archæolithes, I define all those Amorpholithes which previous to use have been subjected to a more or less elaborate dressing which, however, was strictly limited to one face only, the convex indical face (1), while the opposite pollical face always remained flat, and was never subjected to working.

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(1) An explanation and the reason for introducing these new terms will be given later on.

Neither Eolithes nor Archæolithes show the slightest trace of symmetry. Of course, no symmetry can be expected in any casually picked up stone; if it exists, it is accidental and not intentional. One might, however, expect some sort of symmetry in the wrought Archæolithes, but not a single specimen among the numerous Tasmanian Archæolithes, which I examined, has shown the slightest traces of symmetry. Some specimens have come to my knowledge, which prove that a great amount of work must have been spent in working the elaborately chipped, indical face, but the outline of these implements is devoid of all symmetry. And can there be any greater difference, as far as symmetry is concerned, than between the flat, pollical and the convex, wrought indical face?

Now let us turn to the Morpholithes. The chief characteristical feature besides the intentional form is symmetry. The Morpholithes are symmetrical in two directions; the bilateral symmetry is most probably the result of the intentional form, but in addition to this there is no longer a difference between pollical and indical face. In Palæolithic as well as in Neolithic implements, the faces on either side of the working edge are the same. The Palæolithes and Neolithes are wrought on both faces, the Archæolithes on one face only, a fundamental difference, which, in my opinion, has hitherto not been sufficiently recognised.

The above principles have been embodied in the subjoined table, which concisely sets forth the differences between the great groups of stone implements.

<table>
<tr><td colspan="2">Implements<br>*without*<br>an Intentional Form.<br>Unsymmetrical:<br>I. Amorpholithes.</td><td colspan="2">Implements<br>*with*<br>an Intentional Form.<br>Symmetrical:<br>II. Morpholithes.</td></tr>
<tr><td rowspan="3">Implements never wrought or chipped, showing traces of use only.<br>1. Eolithes.</td><td colspan="3">Implements more or less elaborately wrought.</td></tr>
<tr><td rowspan="2">One face only is wrought, difference between Pollical & Indical face. Implements never hafted.<br>2. Archæolithes.</td><td colspan="2">Two faces always wrought, difference between Pollical and Indical face has disappeared. Implements hafted.</td></tr>
<tr><td>Implements more or less elaborately chipped, but never ground or polished.<br>3. Palæolithes.</td><td>Implements more or less elaborately polished and ground.<br>4. Neolithes.</td></tr>
</table>

The different stages of the evolution of technical skill in the production of stone implements is clearly expressed by this table, but, though technically the Eolithes represent the lowest, the Neolithes, the highest types of stone implements, it does not necessarily follow, that from a chronological point of view the Eolithes must always be the oldest, the Neolithes the youngest implements. "Mere roughness of form, unsupported by other evidence, is no proof of the antiquity of an implement," is one of the rules which every student of prehistoric relics should constantly keep in mind.

If we wish to ascertain the age of any stone implement, we must abandon the view of deducing it from form alone, and seek for more reliable evidence elsewhere. The safest, and at the same time most trustworthy evidence, are geological and palæontological data, but these are, unfortunately, not always available. In the absence of reliable data as to age, it is well to remember that, though from a point of technical skill, a certain implement may be much lower than another one, the former may be absolutely much younger than the latter. The Eolithic-Archæolithic civilisation still prevailed in Tasmania, while Europe had already passed through all subsequent stages up to our present day civilisation, and it is more than probable to assume that in the early days of its history certain parts of Europe had already advanced to the Palæolithic, even Neolithic stage, when others still remained in the Eolithic or Archæolithic period.

The study of the Archæolithes has proved that there exists a wide gulf between Amorpholithes and Morpholithes. However rudely finished a Palæolithe may be, by its symmetrical, intentional form, it is closer related to the most highly finished Neolithe, than the most elaborately worked unsymmetrical Archæolithe is to the same Palæolithe. From the most rudely chipped Palæolithe to the most highly wrought Neolithe is only a matter of gradual improvement of the technical methods employed. Palæolithes and Neolithes are merely the starting and terminal point of one continuous chain, but an Archæolithe can never become a Palæolithe without absolutely losing its most essential and characteristic features.

The Archæolithic man grasped his implements with his fingers only, and he accordingly wrought his tools to that effect. Artificial hafting was unknown to him. If he wished to get a firm grip, it was indispensable that the thumb should have a good rest, hence the necessity of producing a good pollical face.

Palæolithic man did not trouble about the production of a pollical face; no longer did he grasp his implements with his fingers. He had made the greatest invention that mankind ever made, that which opened the way to higher evolution, the artificial hafting of his tools. When implements were hafted the necessity of producing a firm rest for the thumb could be dispensed with, both faces could be wrought, thereby unquestionably increasing the efficiency of the tools.

I cannot dwell here on the question of a passage stage between Archæolithic and Palæolithic implements. To us highly civilised beings, the step from an Archæolithe to a Palæolithe is so simple, so easy, that it seems unintelligible that a race existed for uncountable generations without making it; yet it is certain that the Tasmanian Aborigines never made that step. They had reached the Archæolithic stage of evolution, and though this stage must have lasted for an almost unmeasurable period, and though certain individuals must have acquired a great skill in working the indical face, they never got beyond it. There arose no inventive genius among them who substituted the artificial hafting of implements to the natural grasp of the fingers, turning the Archæolithe into the more efficient Palæolithe!

The fact that there existed in Tasmania an absolutely pure Eolithic-Archæolithic civilisation almost up to modern times, is of the greatest interest. Unfortunately, this fact has only been recognised when it was too late to collect information which would have shed a flood of light on the early history of our own race. Many a problem that will remain such for ever, could have been satisfactorily cleared up had the great importance of the Tasmanian race with regard to prehistorical study been earlier recognised. As it is, we have to content ourselves by carefully studying the few indestructible traces the race has left behind, viz., their stone implements, and to attempt combining the results of our studies with the few scanty data that have been delivered to us about the life of the Aborigines. In order to arrive at some conclusions which may be of the greatest importance in clearing up the early history of our race, I will attempt here to give a few observations, based on my own studies, but I wish to state they are far from being exhaustive.

## II.—DESCRIPTION OF THE TASMANIAN AMORPHOLITHES.

### 1.—HISTORICAL SUMMARY.

It would be beyond the limits of this paper to give an exhaustive summary of the work previously done. Apart from a few scattered, though valuable notes in the proceedings of this Society, the most important account will be found in Johnston's admirable Geology of Tasmania. Mr. Johnston was the first who definitely settled the question of the nature of the stone which the Aborigines used for their implements. He proved that this stone was in most cases a metamorphosed sedimentary rock which, by the outbreak of Diabas, had been altered into cherts, hornstones, and porcellanites. Mr. Johnston was also the first to recognise that one side of the implements was invariably flat, while the opposite only was wrought, and that the chipping was always directed away from the flat side, and he particularly dwelt on their unsymmetrical shape. In none of the subsequent books on Tasmania has the subject of the stone implements received the same amount of scientific treatment as in Johnston's Geology.

Another name I wish particularly to mention in connection with this subject is James Scott, once surveyor at Launceston. In a memorandum sent to R. Gunn, Secretary of the Royal Society, written in 1873, Scott makes the following most important statement:—

"In using the flints the thumb was placed on the flat surface, and held by the other fingers resting in the palm of the hand."

To my knowledge this is the only definite statement that has been delivered to us, as to the way the Aborigines held their implements when using them, and as it is made in such a simple, clear and concise way, it is of greater value than a much longer, but hazy description. There can be no mistake as to how the Aborigines held their implements, and all other opinions advanced are not of the slightest value, in face of the statement made by this keen observer. It is most fortunate that this observation has been recorded, but I fairly doubt whether Scott had ever any idea as to its extreme importance, as we will presently see.

I need not dwell on the accounts contained in Brough Smyth's account of the Tasmanian Aborigines, nor on the same subject mentioned in Ling Roth's book on the Aborigines of Tasmania, both are mostly extracts of the papers previously mentioned. The most important reference to this subject is contained in the introduction to Ling Roth's book, written by Professor Edward B. Tylor, who also published a short paper in the Journal of the Anthropol. Inst. of London.

## 2. CHARACTERISTIC FEATURES OF THE TASMANIAN STONE IMPLEMENTS.

If we examine any larger collection of implements made by the Tasmanian Aborigines, the most striking feature we notice is a bewildering mass of forms, none of which are exactly alike, and the total absence of any definite intentional or conventional shape. We may examine them over and over again, there is sort of general likeness, a family likeness so to speak, but each specimen constitutes an individuality of its own, different from all the others. This absolute want of any intentional shape at once fixes their position in the scale of evolution, and they must be considered as belonging to the first and lowest group of stone implements, viz., the Amorpholithes.

The next question to answer is, do they represent Eolithes, Archæolithes, or a mixture of both groups. At first it seems almost hopeless to decide this question; by far the majority of specimens show a flat face, and opposite to it a more or less wrought, convex face. These specimens must be considered as Archæolithes; if we sort out these, there still remain a fair number, which, although they have been used, unquestionably prove that they never were subjected to any kind of working previous to being used. These specimens have all the criteria of the Eolithes.

The Tasmanian stone implements answer, therefore, to the definition of Amorpholithes, and include the two groups distinguished, viz., Eolithes, and Archæolithes. Not a single specimen has come to my knowledge which has been wrought on both faces, and it is therefore absolutely certain that the Aborigines never reached the higher Palæolithic stage of evolution.

The next question to be decided is: Is there any way of further subdividing the above two groups into separate and distinct classes? At first this seems to be a hopeless task, inasmuch as not two specimens are exactly alike. But by observing certain broad principles, which will presently be explained, it is possible to sort out a number of specimens which have some features in common. It will, however, soon be noticed that these groups merge so imperceptibly into each other, that though two specimens representing the extremes of each are apparently widely different in shape, they are so intimately connected by intermediate links, that it is possible to form a continuous chain of passage from one to the other. It is often quite arbitrary whether we consider a specimen as a lamelliform scraper, a chopper or a knife, inasmuch as it might be ranged in any one of these classes.

The difficulties of a systematic arrangement prove conclusively [illegible] of any intentional shape, and also that a certain class of tools was not wrought to serve one purpose, while another was intended for quite a different one (example: knife and battleaxe (celt) of the Palæolithic or Neolithic industry), but that any implement was as fit for the simple purposes it was required as any other specimen.

Before proceeding any further, it may be well to explain two scientific terms which I introduced, in order to render description more concise. Above, I referred to Scott's important observation, that the Aborigines, when using the implements, held them in such a way that the thumb invariably rested on the flat side or face. It is only too natural to distinguish this face as "thumb-face," or to use the more scientific Latin term: Pollical-face, from the opposite one. The opposite, convex, and always wrought face, may fitly be termed Indical-face (from "index," first finger).

The Archæolithic implement, however crudely wrought it may be, will, therefore, always have two distinct physiological faces: the Pollical and the Indical face. In the Eolithic implement, which was grasped without being previously wrought, this difference has not been developed yet, while in the Palæolithic and Neolithic implement it had disappeared again.

This is, in my opinion, the most important discovery the study of the Tasmanian Archæolithes has led to, and as I particularly wish to say thanks to that keen and enthusiastic observer, the late Mr. Scott. None of the authors who have dealt with Archæolithes, not even our greatest authority on the subject of stone implements, Sir John Evans, have recognised that the smooth face of the more primitive "Palæolithic" implements as they were called, is more than an accident resulting from the blow when the implement was flaked or struck off from the parent block. Had it not been for Scott's observation, we would have never known that the flat face of the Archæolithic implement had an important physiological signification, that it was in fact its essential feature, because there were no means of firmly grasping it, unless a flat face was produced on which the thumb could rest. The importance of a smooth and flat Pollical face will at once be seen when we examine a larger collection of Tasmanian Archæolithes. Every specimen that has an elaborately wrought Indical face is invariably distinguished by a particularly even and smooth Pollical face. Not a single specimen have I found in which a highly wrought Indical face was combined with a rough uneven Pollical face. Of course numerous instances occur in which, though the Pollical face is smooth and flat, the Indical face is only moderately worked. However, one thing seems certain, if an aboriginal workman succeeded in striking off a nice flat Pollical face, he usually valued this flake, particularly if it was a fine grained, dark-blue chert, so much that he spent a good deal of work in shaping the Indical face. In my opinion, this observation proves conclusively the importance of the Pollical face, that it was the essential feature of the Archæolithic implement, and that a good flat Pollical face practically determined the working of the Indical face.

I have not the slightest doubt that once the significance of the Pollical face has been recognised in Europe, the study of the Archæolithes will take quite a new turn.

If we now turn our attention to a closer study of the Tasmanian implements, we will find, that irrespective of the purposes for which they were used, the following classes can be distinguished.

## A. NATURAL PIECES OF COLUMNAR DIABAS.

## B. WATERWORN PEBBLES.

- a. One edge has been either used directly without previous work, or a few flakes have been rudely chipped off.
- b. Flakes of Pebbles. The Pollical face is represented by the plane of fracture, the Indical face is formed by the crust of the pebble, or has been slightly improved by chipping.
    1. Indical face unaltered.
    2. Indical face chipped.
- c. Flakes of Pebbles, in which the Indical face is represented by the plane of fracture.

## C. IRREGULARLY SHAPED, ANGULAR IMPLEMENTS, GENERALLY OF CONSIDERABLE THICKNESS, AND FREQUENTLY OF LARGE SIZE.

- a. Irregular lumps showing traces of a considerable amount of work being spent on them. These may be either nuclei or unfinished rejects.
- b. Irregular, angular fragments, without a well-defined Pollical face, probably mostly waste from the manufacture of other specimens.
    1. Edges merely used.
    2. Edges trimmed previous to use.
- c. Specimens showing a distinct Pollical face, which is generally rather uneven. The Indical face shows a few large flakings.
    1. Edges merely used.
    2. Edges trimmed previous to use.

It is often difficult to keep groups C.b and C.c separate from the more lamelliform instruments of group D., and it is almost impossible to distinguish the more elaborately worked implements of Cc/2, and those of group Ea. Likewise the three groups pass into those of group F.

## D. LAMELLIFORM IMPLEMENTS.

These are flakes properly speaking, and they are distinguished from the former by their small thickness, and being struck off from a large piece of rock, they naturally show a well marked Pollical face. They are distinguished from group B.b. by the natural crust being removed by working.

a. Specimens of very irregular shape, without any traces of use, or chipping. These are evidently rejects.

b. The same as the former, but the edges show traces of use.

c. Like the former, but the Indical face is roughly flaked, and the edges trimmed and used.

d. Semicircular flakes. The convex edge is generally nicely trimmed.

e. More or less oval or quadrangular flakes, whose Indical side is well worked with trimmed edges.

f. Like the former, but of more discoidal form.

## E. CHOPPERS.

Under these names I include all those implements of considerable thickness in which the length does not much exceed the breadth, with a well-developed Pollical, and a more or less elaborately wrought Indical face. The edges are mostly neatly trimmed. This group comprises the most highly finished Archæolithes, and, as it is naturally a large one, a number of sub-groups can be distinguished. If the thickness becomes small, it is often impossible to distinguish it from the former group, or if the Indical face is not much wrought from group Cd.

a. Specimens of somewhat irregular shape.

b. Specimens of circular shape; when these specimens are rather thin it is impossible to keep them separate from D.f.

c. Specimens of oval shape. According to thickness this group passes either into De., Eg., or Fg.

d. Specimens of more or less quadrangular shape.

e. Specimens of trapezoidal shape. This group forms the passage between the former and the following one.

f. Specimens of triangular shape. These form a very interesting group, and at least ten subgroups could be distinguished These are:

1. Right-handed specimens.
2. Left-handed specimens.
3. Isocoecle specimens with concave basis
4. Isocoecle specimens, with convex basis.
5. Isocoecle specimens, with convex basis, rather thin.
6. Isocoecle specimens, both sides concave.
7. Rather flat, with strongly convex basis.
8. Rather flat, with left side concave.
9. Rather flat, with right side concave.
10. Specimens with rather a convex Pollical face.

g. Specimens of great thickness, in which the length exceeds breadth considerably. These specimens practically form the passage to the following group. On account of their thickness they cannot be classified as knives, though on account of their elongated form they ought to be included among the following group.

## F. KNIVES.

Under these names I include all those implements in which the length considerably exceeds the breadth. The typical specimens are rather thin, and link themselves by this feature to group D.e. (lamelliform flakes of oval shape). Other specimens are of a considerable thickness, and in that case it is difficult to distinguish them from group E.g.

According to the number of longitudinal ridges on the Indical face two large sub-groups can be distinguished, viz:—

I. One-ridged specimens. This type has only one longitudinal ridge more or less in the middle of the Indical face.

a. Specimens of considerable thickness, frequently pointed at one, sometimes at both ends. (See E.g.)

b. Flat specimens, pointed at one end.

c. Long and narrow specimens, both edges well trimmed.

d. Short and broad specimens almost triangular.

e. Specimens ending in a very sharp point, generally of considerable thickness, and with a rather irregularly worked Indical face.

g. Rounded at one end.

II. Two-ridged specimens. In this specimen the median ridge has been removed by striking off a longitudinal flake, and, instead of one, there are now two longitudinal ridges.

h. Flat and rounded at one end.

i. Flat and pointed at one end.

k. Flat and rounded, but having both the longitudinal peculiarly curved.

l. Rather thick and rounded at one end.

## G. CONCAVE SCRAPERS.

This group includes all those specimens with one or more concave edges. If two edges are concave, they are separated by a most peculiar tongue or bill-shaped protuberance, which is sometimes pointed; sometimes rounded.

a. One concave edge only.

b. Two concave edges; protuberance rather long, rounded at the end. (Duck-bills).

c. Two concave edges; protuberance short pointed.

d. Protuberance short, broad and rounded, not well set-off against the edges.

e. Triangular implements, with broad butt-end, and two concave longitudinal edges. (Langues-de-chat).

## H. COMBINATION IMPLEMENTS.

In this kind of implements one edge has been used as a knife or chopper, while the one or two more have served as hollow scrapers.

## I. IMPLEMENTS, DOUBLE-EDGED.

In these the traces of use are on one edge restricted to the Indical, on the other to the Pollical face.

## K. RECHIPPED IMPLEMENTS.

Specimens which, after having been used and rejected, have been picked up by a later generation, with a view of using them again.

## L. PIECES OF GLASS.

## M. MAGIC OR SACRED STONES.

This is a very peculiar group of the Tasmanian stone implements, and consists of waterworn pebbles, mostly of Diabas, which were subjected to a very rough treatment.

a. Flat boulders, showing a rough indented depression in the centre of either both or one face only. The edge is frequently very much battered.

b. Flat boulders which have been subjected to a considerable amount of grinding.

## N. HAMMERSTONES.

Spherical pebbles of Diabas, more or less battered all over the surface.

## O. PIECES OF RED OCHRE.

## P. UNFINISHED REJECTS AND BROKEN IMPLEMENTS.

## Q. SPECIMENS FOUND IN NATIVE QUARRIES.

These naturally include all the groups above mentioned.

## R. SPECIMENS WHICH HAVE BEEN EXPOSED TO THE ACTION OF FIRE.

This classification distinguishes, therefore, 17 main groups, or, if we omit group P, the broken and unfinished specimen group, Q, those found in quarries, and R, and distribute them among the others, there remain 14 main groups divided into 55 classes and sub-classes. This may, perhaps, seem somewhat astonishing, considering the limited purposes to which these primitive implements were applied, but I cannot sufficiently lay stress on the fact that the above classification is a purely artificial one. Some sort of classification or system is indispensable in order to master this chaos of forms, and the above is the outcome of several attempts. Whatever its faults may be, and they are probably numerous, it has one great advantage, it is elastic. New classes can be added to the main groups, and even some of those now existing can be cancelled without materially altering the whole system. If it is borne in mind that various groups and sub-groups pass so imperceptibly into each other it would, perhaps, be better to reduce their number. It is difficult to decide whether such a course would be advisable or not.

Supposing we were to deal only with those Archæolithes which actually served as tools, therefore omit groups M. (magic stones) and O. (red ochre); and distribute the following groups: K. (rechipped implements); P. (broken and unfinished rejects); H. (combination tools); I., L., N., (hammerstones); Q. (specimens found in quarries); R. (specimens which have been exposed to fire), among the other groups, and if we further distributed parts of group B. (waterworn pebbles and flakes thereof), as well as group C. among the remaining groups, the result would be the following five large groups:—

I. Archæolithes of considerable thickness, in which the length does not exceed the width: Choppers.

II. Archæolithes of small thickness, in which the length does not considerably exceed the width: Scrapers.

III. Archæolithes in which the length considerably exceeds the width: Knives.
  a. Thick and pointed, or rounded.
  b. Thin and pointed, or rounded.

IV. Archæolithes with one or more concave edges: Concave Scrapers.

Such a simple classification would have its undoubted advantages; but if we were to carry it out in practice, we would find the groups so large and unwieldy that a further subdivision would soon be necessary. It could not be considered as a very natural one, either, because a thinner chopper could serve as scraper, and a more elongated scraper as a knife; while one edge of a conveniently shaped concave scraper may have been used as a chopper, a scraper, or a knife. On the whole, I therefore think that the more detailed classification is the practical, because it allows any implement to be classified.

## 3. DESCRIPTION OF TYPES REPRESENTING THE DIFFERENT GROUPS OF AMORPHOLITHES.

### A. PIECES OF COLUMNAR DIABAS. (1.)

These specimens are well-known to every collector of Tasmanian implements, and they are invariably, though not very frequently, found on every camping ground.

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(1) Much as I would like to illustrate each of the groups above distinguished by giving a representative photograph, I must, on account of expenses, limit myself in reproducing the most important types only. For a similar reason, and in order not to make the paper too lengthy, I must restrict myself to groups A-H, and M, omitting all the others. Those who wish to inform t [illegible] t of native quarries (Q), and the magic stones (M), I refer t [illegible] Naturalist, No. 2 and 3, in which these subject [illegible] *I propose dealing* with those that are still ou [illegible] *and the pieces* of glass, as well as a [illegible] *Amorpholithes* in subsequent papers.

### FIG 1. (2.)

### PIECE OF COLUMNAR DIABAS: Geilston.

This prototype of every human tool is nothing else but a piece of columnar Diabas, which has been picked up at such places where the Diabas on cooling from its molten state, instead of contracting into huge columns, produced smaller ones, which were from their shape eminently suitable as choppers. Had the rock been less brittle, these natural pieces of Diabas would have been very efficient tools, but their extreme brittleness made them very unsuitable even for the limited wants of the Tasmanian Aborigines. Space does not permit to dwell longer on this type, which is full of the deepest interest. I shall have, probably, an opportunity of dealing with this subject in a separate paper.

## B. WATERWORN PEBBLES.

Next to the pieces of columnar Diabas, ordinary waterworn pebbles represent the lowest type of implements. Any flat pebble might be used, provided it had a fairly sharp edge, which made it suitable as a chopping tool without previous trimming. A very characteristic specimen is shown in the following figure.

### FIG. 2.

### Ba. WATERWORN, FLAT PEBBLE USED AS CHOPPER. Shene (Pontville).

Another more frequent type are pebbles which, at the butt end, still preserve their original surface, while the other end is more or less flaked. It is difficult to say whether these traces of wear and tear are solely due to use, or to intentional flaking, the result will in both cases be practically the same, though it is evident that both represent two different classes of implements. The former are Eolithes, the latter are Archæolithes, which were never finished, and rejected.

The most frequent types of group B, which can also
be considered as the lowest Archæolithic type, are flakes
of pebbles still prese [illegible] their original crust as the In-
dical face, but being [illegible] characterised by a Pollical
face. In thickness, as [illegible] shape, these flakes vary
[illegible] that they have been
[illegible] Evans calls this
[illegible] er ones, which

had a fairly good Pollical face and a sharp edge were utilised without further improvement, while it seems fairly certain that others were intended for further improvement, but that for some reason or other they were rejected without being finished, though it appears that in some instances even these uncompleted implements were used. A good specimen of an external flake, which was utilised just as it came off from the parent block, is shown in fig. 3

FIG. 3.

Bb/1. TYPE OF EXTERNAL FLAKE, SHOWING TRACES OF USE ALONG THE UPPER EDGE.

Found by Mr. L. Brownell, at Geilston.

Another specimen, of the more elongated kind, which shows traces of work on the Indical face, is represented in fig. 4.

FIG. 4.

Bb/2. TYPE OF ELONGATED EXTERNAL FLAKE, SHOWING TRACES OF FLAKING AT THE BROADER END. (BUTT END.) Old Beach.

The specimens here figured shows distinctly that it has been subjected to a good deal of flaking, and the left edge has apparently been used. It is impossible to say whether the flaking of the Indical face is intentional, and the specimen is a half-finished reject, or whether the chips came off when other specimens were previously struck off from the same block. A mis-spent blow at the broader end seems to indicate that it was intended to turn the flake into a more serviceable tool, and that, therefore, the working of the Indical face was due to intention, and not only to utilisation. The most remarkable of this group are a small number in which the flat face shows traces of working, instead of being used as Pollical face. Specimens of this kind are pretty rare.

### C. IRREGULARLY SHAPED ANGULAR IMPLEMENTS, GENERALLY OF CONSIDERABLE THICKNESS, AND FREQUENTLY OF LARGE SIZE.

This group comprises a large number of Archæolithic implements, and it can be considered as the next *stage* between the external flakes and the more highly-wrought Archæolithes. If we imagine the Indical face of an external flake a little more worked, we arrive at this stage. On the other hand, it is pretty certain that larger splinters, resulting from the breaking of a block, were used, whether they presented a good Pollical face or not; specimens of this type are very common, and a good representative is shown in the following figure.

FIG. 5.

Cb/1. ANGULAR ARCHÆOLITHE, WITHOUT A POLLICAL FACE, SHOWING TRACES OF UTILISATION. Old Beach.

Not unfrequently a certain amount of work was spent in trimming the edge of such a splinter, though the Pollical face was all but serviceable, a specimen of this type is shown in the following figure.

FIG. 6.

Cb/2. ANGULAR ARCHÆOLITHE, WITHOUT A REGULAR POLLICAL FACE, BUT WITH A BEVELLED CUTTING EDGE: Geilston.

The next higher stage are specimens which have a well-marked Pollical face, without much work being spent in trimming the Indical face; the edges may have been used, just as they were if sharp, or subjected to previous trimming. If a little more work has been spent in working the Indical face, it is almost impossible to distinguish such specimens from those of group Ea. A specimen of the former type is shown in fig. 7.

FIG. 7.

Cc/1. ANGULAR ARCHÆOLITHE WITH A GOOD POLLICAL FACE; LEFT EDGE USED WITHOUT TRIMMING. (1) Maryvale (Tea Tree).

This group includes some of the larger specimens that have come under my notice, one of them measuring 5½ x 5⅛ inch, and another 7½ x 4½ inch. It is, however, very probable that specimens of this type must be considered as rejects.

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(1) The specimen above figured is also a good instance of re-chipping; the traces of use on the left edge are without a patina, while those on the upper and right edge (not visible in the figure) as well as the remainder of the surface on both faces are covered with a greyish-white patina.

Another type included in this group are specimens from which it is impossible to say whether they are nuclei, or unfinished rejects. These specimens are frequently of a large size, and to the casual observer they would appear to have been worked all round on every side. It is, however, obvious that these specimens cannot be considered as implements, which it was intended to work on both faces. In the first instance, their lumpy form, the entire absence of any shape, proves that they must be either nuclei or unfinished rejects. I found one of these specimens near Kempton, and the flakes that had been struck off were still lying around it, and could be fitted into their places. We have here clearly a nucleus, and its flakes, both being rejects. Other specimens equally prove that numerous attempts had been made to produce a smooth Pollical face, but either owing to the nature of the rock or ill-directed blows, these attempts failed, and the specimen was rejected.

## D. LAMELLIFORM IMPLEMENTS.

This group is distinguished from the former chiefly by its smaller thickness, and that more specimens show that a considerable amount of work has been spent, not only in trimming the Indical face, but also bevelling the edges. We might consider them as flakes of group Bb/2, whose Indical face has been so much worked that original crust has entirely disappeared. (1).

I think this group includes all those which Sir John Evans has termed "trimmed flakes."

The lowest type are flakes with a good Pollical face, whose Indical face has been wrought by one or a few more large chips being struck off. The sharp edges were generally utilised without previous bevelling. Fig. 8 is a good illustrative specimen of this type.

FIG. 8.

Cb. LAMELLIFORM ARCHÆOLITHE (TRIMMED FLAKE), SHOWING A SLIGHTLY WORKED INDICAL FACE, AND TRACES OF USE AT THE LEFT EDGE. South Arm.

The next figure shows a lamelliform implement, whose Indical face has been more elaborately worked.

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(1) *Frequently* enough small traces of the original crust still adhere to the *implement.*

FIG. 13.

Ea. COMMON CHOPPER, WITH WELL-FORMED POLLICAL AND CHIPPED INDICAL FACE. Geilston.

The next figure shows a more discoidal form.

FIG. 14, 14a, 14b.

Eb. DISCOIDAL CHOPPER, WITH PARTICULARLY FLAT POLLICAL FACE; INDICAL FACE, WELL CHIPPED; TRIMMED AND WORKED ALL ROUND. Maryvale (Tea Tree).

Fig. 14, Indical face. Fig. 14a, Pollical face. Fig. 14b, side view.

When of a more elongate form, oval-shaped implements are produced which gradually pass by decrease in thickness, either into lamelliform Archæolithes of group D, or into cultelliform types of group F. A fine specimen is represented in fig. 15.

FIG 15.

Ec. OVAL CHOPPER, WITH ELABORATELY CHIPPED INDICAL FACE. Found by Mrs. Oldmeadow, Woodlands, Melton Mowbray.

The oval form gradually leads of over to more quadrilateral specimens, of which the following is the most characteristic type.

FIG. 16.

Ed. QUADRILATERAL CHOPPER. ELABORATELY WORKED. Melton Mowbray.

The next type, the trapezoidal shape, also evolves from the elongate forms.

FIG. 17, 17a, 17b.

Ee. TRAPEZOIDAL CHOPPER. ELABORATELY WORKED. Maryvale (Tea Tree).

Fig. 17, Indical face. Fig 17a, Pollical face. Fig 17b, side view.

If the former type is carried to its extreme by continuing the two longitudinal edges till they intersect, the triangular forms result, of which as many as nine or ten varieties have been distinguished. I select only two of the most characteristic forms.

### FIG. 11.

Ce. **LAMELLIFORM ARCHÆOLITHE (TRIMMED FLAKE), SHOWING SEMI-CIRCULAR BEVELLED EDGE, CONCAVE AT THE LOWER PART.** Woodlands (Melton Mowbray).

It is very difficult to suppress the notion that the semi-circular edge was intentional and not accidental, because it is not only restricted to the lamelliform group of Archæolithes, but occurs in the next group just as well. Sir John Evans states that to this form the name of scraper has been applied from its still being used in that capacity by the Eskimos. (Ancient stone implements, page 643).

Another not unfrequent type are the Lamelliform Archæolithes of discoidal shape, as shown in fig. 12.

### FIG. 12.

Cf. **LAMELLIFORM ARCHÆOLITHE (TRIMMED FLAKE), OF DISCOIDAL FORM; EDGES BEVELLED AND USED.** Old Beach.

It is very difficult to keep this group separate from group Eb., if the thickness increases somewhat, and though there is no doubt about the extremes of both groups, the intermediate stages are difficult to classify.

## E. CHOPPERS.

Under this heading I comprise all those Archæolithes, of considerable thickness, but very various shape, which are distinguished by a nice flat Pollical and a usually elaborately chipped Indical face, in which the length, as a rule, does not considerably exceed the breadth.

This group includes the largest number of Archæolithes, and it gradually passes on all sides, so to speak, into the different groups here distinguished. When the thickness becomes smaller, it is impossible to draw a sharp line between this group and the lamelliform trimmed flakes. If the Indical face is less elaborately worked, it merges into group C, if the length begins to exceed the breadth a separation from group F difficult.

It is impossible to give here the forms which are included in this group, and I m yself in selecting a few of the most ch cter

The most c ewhat irregular sh , or or less *elaborately* w

### FIG. 13.

Ea. COMMON CHOPPER, WITH WELL-FORMED POLLICAL AND CHIPPED INDICAL FACE. Geilston.

The next figure shows a more discoidal form.

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Eb. DISCOIDAL CHOPPER, WITH PARTICULARLY FLAT POLLICAL FACE; INDICAL FACE, WELL CHIPPED; TRIMMED AND WORKED ALL ROUND. Maryvale (Tea Tree).

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## E. CHOPPERS.

Under this heading I comprise all those Archæolithes, of considerable thickness, but very various shape, which are distinguished by a nice flat Pollical and a usually elaborately chipped Indical face, in which the length, as a rule, does not considerably exceed the breadth.

This group includes the largest number of Archæolithes, and it gradually passes on all sides, so to speak, into the different groups here distinguished. When the thickness becomes smaller, it is impossible to draw a sharp line between this group and the lamelliform trimmed flakes. If the Indical face is less elaborately worked, it merges into group C, if the length begins to exceed the breadth a separation from group F is difficult.

It is impossible to give here all the forms which are included in this group, and I must restrict myself in selecting a few of the most characteristic types.

The most common type is an implement of somewhat irregular shape, of considerable thickness, and more or less *elaborately* worked Indical face, as represented by fig. 13.

FIG. 13.

Ea. COMMON CHOPPER, WITH WELL-FORMED POLLICAL AND CHIPPED INDICAL FACE. Geilston.

The next figure shows a more discoidal form.

FIG. 14, 14a, 14b.

Eb. DISCOIDAL CHOPPER, WITH PARTICULARLY FLAT POLLICAL FACE; INDICAL FACE, WELL CHIPPED; TRIMMED AND WORKED ALL ROUND. Maryvale (Tea Tree).

Fig. 14, Indical face. Fig. 14a, Pollical face. Fig. 14b, side view.

When of a more elongate form, oval-shaped implements are produced which gradually pass by decrease in thickness, either into lamelliform Archæolithes of group D, or into cultelliform types of group F. A fine specimen is represented in fig. 15.

FIG 15.

Ec. OVAL CHOPPER, WITH ELABORATELY CHIPPED INDICAL FACE. Found by Mrs. Oldmeadow, Woodlands, Melton Mowbray.

The oval form gradually leads of over to more quadrilateral specimens, of which the following is the most characteristic type.

FIG. 16.

Ed. QUADRILATERAL CHOPPER. ELABORATELY WORKED. Melton Mowbray.

The next type, the trapezoidal shape, also evolves from the elongate forms.

FIG. 17, 17a, 17b.

Ee. TRAPEZOIDAL CHOPPER. ELABORATELY WORKED. Maryvale (Tea Tree).

Fig. 17, Indical face. Fig 17a, Pollical face. Fig 17b, side view.

If the former type is carried to its extreme by continuing the two longitudinal edges till they intersect, the triangular forms result, of which as many as nine or ten varieties have been distinguished. I select only two of the most characteristic forms.

not often pointed, but mostly rounded off at one end at least. So far, no complete specimen has come under my notice, they all appear to have been broken.

FIG. 24.

F2/h. TWO-RIDGED KNIFE. Melton Mowbray.

## G. CONCAVE SCRAPERS.

This is a curious group, which is distinguished by one or two more or less concave edges. If there are two concave edges, they are separated by a tongue-shaped protuberance, which shows always a median longitudinal ridge, and is usually, but not always, rounded off at the end. It is difficult to say whether the concave edges are intentional or the result of utilisation. In most cases, when there is only one concave edge, it is very probable that the curved outline is the result of wear and tear, by continuous scraping off a rounded object (spear). In others, it seems equally certain that the concave edges are trimmed and, therefore, intentional. Among the large number I select only a few specimens.

The specimen shown in the next figure is in some ways rather a remarkable one; it is distinctly a one-edged concave scraper, but it is also certain that the other side has been considerably used, and as the concave edge was apparently bevelled previous to use, a sort of longitudinal ridge is produced, which gives it the tongue-shaped appearance of the double scrapers.

FIG. 25.

Ga/b. ONE-EDGED CONCAVE SCRAPER. Maryvale (Tea Tree). Found by Mrs. Percy Butler.

The next specimen is a typical double-edged concave scraper, of the type which have been termed "duck bills." The tongue-shaped "bill" is in this specimen rather long, while in fig. 27 it is very short, though rounded, and in fig. 28, short but pointed.

FIG. 26.

Gb. DOUBLE-EDGED CONCAVE SCRAPER (DUCK-BILL). Old Beach.

FIG. 27.

Gb. DOUBLE-EDGED CONCAVE SCRAPER (DUCK-*BILL*, SHORT-TONGUED). Maryvale (Tea Tree).

FIG. 28.

Gc. DOUBLE-EDGED CONCAVE SCRAPER, WITH A VERY SHORT, POINTED TONGUE. Old Beach.

The last of the specimens included in this group is rather a peculiar one. Its general outline is triangular; the butt-end rather broad, somewhat rounded; the upper end pointed, but rounded off. The two side edges are fairly concave, and on the Indical side is a median ridge. This implement bears the greatest similarity to the langues-de-chats of the French Archæologists. This type is not very common, but it is obvious that it belongs to the group of the double-edged concave scrapers.

FIG. 29.

Ge. DOUBLE-EDGED CONCAVE SCRAPER (Langue-de-chat). Melton Mowbray.

## H. COMBINATION IMPLEMENTS.

The necessity of dealing with these implements under a separate heading may, perhaps, be questioned, inasmuch as numerous other specimens have most probably been utilised for different purposes. There are, however, some very peculiar specimens among this group, which are better kept separate from the others. The most common form these implements take is that one or two edges have been used as concave scrapers, while the other served as chopper or knife. The following is a very illustrative example.

FIG. 30.

H. TYPICAL COMBINATION IMPLEMENT. LEFT EDGE USED AS SCRAPER OR CHOPPER. (NOTE THE SEMI-CIRCULAR SHAPE. LOWER EDGE AS CONCAVE SCRAPER.) Melton Mowbray.

It is easy enough to imagine that with an implement of the above kind, a wooden spear could be manufactured from start to finish without any other tool being required.

## 4. THE USE OF THE AMORPHOLITHIC IMPLEMENTS.

It is only too natural that the inquiring mind turns towards the question of utilisation when a collection of these amorphous stone implements is examined. To our modern mind it is almost incomprehensible that these crude implements could have served to any useful purpose, and yet they must have, otherwise it is not probable that their manufacturer would have spent so much labour in shaping them.

Luckily, we have at least so much information about the habits and customs of the Aborigines that we can arrive at a very correct idea as to the various purposes these Amorpholithes were used for.

One of the most important observations has again been handed over to us by Scott. He states: "The flints were used principally for cutting and sharpening spears, waddies, and for making notches or rough edges on the end of the waddies. . . They were also used for cutting notches in the bark of the trees." Scott tells us that the principal object for which these crude implements were used was the cutting and sharpening of their wooden spears, they were, therefore, essentially cutting or chopping tools.

On the other hand, it is certain that Scott's statement of the purposes for which the flints were used is not quite exhaustive. We know that sharp specimens were used for nicking off the hair of the women and for the production of scars on the flesh of the men. It is also on record that "sharp flints" were used to open up the roasted animals they used for food, and it is also fairly certain that sharply-pointed specimens were used to drill holes into the shells and bones they used to wear as ornaments. The question therefore remains, are the purposes enumerated exhaustive or not? Some of the implements that have come under my notice are most suggestive of a spear or arrow head, and had they been found in Europe they would without the slightest hesitation been pronounced as such. The following three figures, of fictious spear and arrow heads, will amply illustrate this view.

FIG. 31.

FICTIOUS SPEAR HEAD. REALLY A KNIFE OF GROUP Fc. Old Beach.

FIG. 32.

FICTIOUS ARROW HEAD. (NOTE THE BEAUTIFULLY-MADE TANG FOR INSERTION INTO THE SHAFT). REALLY KNIFE OF GROUP Fc. Maryvale.

## FIG. 33.

## FICTIOUS ARROW HEAD. REALLY KNIFE, SCRAPER OR BORER. Old Beach.

We are luckily in the position to answer the above question conclusively and in the negative. The altercations between Aborigines and Europeans have been frequent enough ever since their first hostile meeting in 1803, but though the accounts are dramatic in every way, not a single one mentions that the Aborigines used bow and arrow or spears provided with stone heads. Particular stress is always laid on the fact that their only weapons were wooden spears, though they occasionally seemed to have resorted at throwing a shower of stones at their assailants. It is, therefore, absolutely certain that neither the use of bow and arrow, nor the mounting of their wooden spears with stone heads, was known to the Aborigines. We can, therefore, at once refute any attempt to recognise arrow and spear heads among the Tasmanian Archæolithes, however suggestive the form of such an implement may be.

Scott, as well as other observers, state that the Aborigines never used the "flints' as tomahawks. In order to be effective, a tomahawk, battleaxe, or celt requires an artificial handle, the stone must be hafted. Now, as the Aborigines never used any hafted tool or implement—on this point we have the emphatic statement of Scott and others—it is equally certain that there are no tomahawks, battleaxes, or celts among the Tasmanian Archæolithes.

One of the most important purposes for which the stone implements of a higher stage of civilisation were used, viz., as weapons of offence and defence, does therefore not apply to the Archæolithes of Tasmania, and this, at once, considerably restricts their scope of utilisation. If the Tasmanian Archæolithes were neither weapons of offence nor defence, they can have only been used in connection with the performances of domestic life, if this word be permitted.

Enough has been handed over to us to know that this daily domestic life was of the most primitive fashion, and mainly consisted in providing for food. They had no houses, huts, or tents; they had no industries, the only art they understood was the plaiting of baskets. The use of the saw, however inefficient it may have been, was wholly unknown to them. We can, therefore, still further restrict the scope of use of the Archæolithes, and arrive at the conclusion that the Archæolithes were in the first and principal instance cutting instruments in the broadest sense of the word, and the conclusion thus arrived at is, therefore, fully in harmony with Scott's statement.

It is certain that the Archæolithic and, perhaps, also some of the Eolithic implements were chiefly used in the manufacture of the wooden spears and waddies. It is almost sad to think what an enormous amount of time and labour has been spent by the Aborigines, mainly to shape these poor tools in order, produce with their assistance an equally inefficent weapon. It is almost incomprehensible to our modern mind, that not one of these human beings that were born, lived and died, for generations uncounted, had the inventive genius or lucky idea to improve the efficiency of their stone implements by substituting the artificial handle to the natural one of the hand. This is, to my mind, one of the greatest problems in the psychology of this race.

If we muster a collection of Tasmanian Archæolithes in order to ascertain which of them were most suitable for the above mentioned purpose, we find that, except a few thin flakes, (group D) and some of the thin and pointed knives of group F, almost every specimen could be used in the manufacture of spears. The concave scrapers (group G) were most probably used to give the last polish, and to sharpen the end.

The heavier and stronger Archæolithes and, in particular, most probably the Diabas Eolithes were used for cutting notches into the bark of trees, which were ascended to hunt for opossums. (1).

The more delicately wrought lamelliform implements of groups D and F were probably used as knives for cutting the meat of roasted animals, as well as in skinning them, if ever a skin was required. The sharpest specimens were probably used to produce the scars, and to cut the hair, though the latter could be equally well, if not better, performed with two more solid implements as long as the working edge was sharp enough.

Those implements which terminated in a particularly acute point, group Fe., and, perhaps, also those of group Gc., were used as borers to perforate the shells and bones worn as ornaments.

Another purpose for which some of the Archæolithes may have been used, was probably for lighting a fire. Ling Roth is very adverse to this view, notwithstanding the evidence of Furneaux and La Billardiere. Sir John Evans has, however, proved that primitive man of Europe produced fire by means of a piece of iron pyrites and a flint. Iron pyrites, or, for the matter of that, copper pyrites is by no means rare in Tasmania, and the probability that one of the pieces of "flint" found in the baskets by La Billardiere was really a piece of pyrites is by no means small. That such a piece was not correctly designated as such, but simply called flint, is more than probable; in fact, the contrary would have been more astounding, considering that these men, however good sailors and explorers they may have been, probably never noticed such details which would even tax the power of observation of the modern scientist to the utmost.

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(1) Several writers refer to the fact that the women, when ascending the tree, used to carry the stone implement on their heads. The flat columnar pieces of *Diabas* would be eminently suitable for such a purpose if in general use, and not only *occasionally* resorted to.

This pretty well exhausts the purposes for which the Tasmanian stone implements were used, and the only question which remains to be examined is, how were the Archæolithes produced. Again we turn to Scott for information. He states that he had "seen the men sitting for an hour or so, at one time, chipping one flint with another." Here we come to another stumbling block, was it really one "flint" that was used to work or chip the other "flint," that is to say, was the "hammer" used in the production of an implement of the same material as the latter, that is to say, a cherty rock, or is it not possible that the "hammer" was of a different material altogether. It is a favourite theory of numerous collectors to assume that certain specimens belonging to my group, Mb. were used as "hammer stones." I have my great doubts as to the correctness of this view, but other specimens belonging to group N most forcibly suggest the idea of being used as hammerstones. A typical specimen is here reproduced.

FIG. 34.

N. HAMMERSTONES. South Arm.

On the other hand it seems very improbable that these clumsy Diabas pebbles could be used to produce the neat trimming some of the more highly finished specimens show, although it cannot be denied that they were good and serviceable implements to strike off the first flakes from a larger block. It is, perhaps, probable that the larger spherical hammerstones were used to detach the first flakes, and that more handy, sharply-edged pieces of chert were used in working and trimming the specimens thus obtained. We might imagine that the common angular fragments or flakes that fell off when a large block was broken were used for such a purpose. It seems, for instance, more than probable that the numerous pieces lying about in the quarry on Coal Hill (Melton Mowbray) were used for trimming other specimens; the presence of almost countless fragments, whose edges show unmistakable signs of use, is otherwise quite inexplicable. I am afraid that this question will never be satisfactorily solved, and though we may take it as certain that stones were used in order to trim the Archæolithes subsequently used for cutting purposes; and though with a certain amount of probability we can consider a certain group of spherical Diabas pebbles as hammerstones, it will be almost impossible to distinguish those which were used in trimming the implements from the Archæolithes used for general cutting purposes.

## 4. ANTIQUITY OF THE AMORPHOLITHES FOUND IN TASMANIA.

Having described the general features of the Amorpholithes and their use, the question of antiquity arises, as a matter of course. Even the most casual observer will notice two facts, viz.:

a. That no implements of a higher stage (Palæolithic or Neolithic) have been found in Tasmania.

b. That the race which used the Amorpholithes must of necessity have migrated to the island previous to its separation from the mainland of Australia.

The fact that no stone implements of the higher order have been found in Tasmania up to the present time may be taken as certain. Of course this does not prove that they do not exist, but inasmuch as numerous collectors have lately interested themselves in these relics of the past, it is only fair to assume that stone implements of the higher orders had come to light if they existed. If they exist at all, they must be buried deep in the soil, or in cave deposits hitherto unexplored; but I have the greatest doubts as to their existence, because if such implements were found in Tasmania they would prove that either a higher civilised race lived in Tasmania previous to the arrival of the Aborigines, or that that race degenerated since their arrival from a higher state into a lower one. Though not impossible, I think both theories to be highly improbable.

The second point is at once clear. We know that the Aborigines of Tasmania possessed no knowledge of seafaring; it is therefore absolutely certain that they cannot have crossed Bass Strait, but must of necessity have migrated to the present island previous to its separation and inhabited it when this great geological catastrophe took place.

Now, if we examine the camping grounds on which the implements are found, we notice several other interesting facts. All the camping grounds appear to be of comparatively recent age, none of those I have hitherto visited gave me the impression as if it had been used for a very lengthy period. Anybody who has seen the sites of old inhabited places in India, Persia, or Egypt knows the enormous amount of refuse that collected there as the waste of past generations. However simple the wants of our Aborigines may have been, there was always a certain quantity of waste, and this must have, in the course of time, accumulated, forming a large heap of refuse on the camping grounds. But such a layer of refuse is entirely absent in the camping grounds. The most natural explanation is, to assume that the camping grounds were used for a short time only, and constantly shifted. However tempting this view may be, there is a serious objection to it. Three things were absolutely essential for a camping ground: Fresh water, a plentiful supply of food, and a warm soil permeable to water.

As the Aborigines possessed no vessels whatsoever in which to carry any water, except occasionally in a shell, the nearness of fresh water was absolutely indispensable for a camping ground. The nearness of food was not so necessary; it could be carried in baskets for any reasonable distance, if necessary, and as long as the supply was plentiful in the neighbourhood, any place near fresh water was suitable, provided it fulfilled the third condition. This is, perhaps, the most curious of all. A little observation proves that almost all camping grounds were situated on sandy soil. If a small island of sand occurs in a large area of argillaceous soil, we may be almost certain to find a large number of implements on that spot, even if not a single specimen is found all around it. I had this proved over and over again by actual observation, and in hunting up new sites I always find out the sandy places, and I am rarely disappointed.

The Aborigines neither camped on rocky, nor on heavy clayey soil, and the reason for this is obvious. Rocky ground can never be considered as comfortable, argillaceous soil becomes slushy in the rain; but the sandy soil is soft, warm, and the rain water soon disappears and leaves it dry. I do not say for a moment that there were no exceptions to this rule, but taken a supply of fresh water and plenty of food, the Aborigines always selected the sandy soil in preference to any other for their camping sites.

Now, it is only fair to assume, that if the Aborigines never dwelt for any length of time at any of these places, but always shifted to new ground after a time, the available localities must eventually become exhausted. Former camping grounds had, therefore, to be revisited, and this must eventually result in the accumulation of large heaps of refuse such as we observe, for instance, in the cave deposits in Europe. But, as already stated, these heaps of refuse are wanting in the Tasmanian camping grounds, and the only refuse we note are here and there a few traces of ash or charcoal and stone implements, which are limited to a layer of not more than 6 to 12 inches from the surface.

The only accumulations of refuse we observe in Tasmania are the shell heaps along the sea coast and the estuaries of the bigger rivers. The accumulation of these shell heaps is easily accounted for, and is of no special interest; inasmuch as a large shell heap must collect within a comparatively short time. (1.)

If we examine the situation of the shell heaps and the old camping grounds, it becomes at once unquestionable that both came into existence not previous, but after the present system of drainage had been established; in other words, after Tasmania had acquired its present shape, that is to say, become separated from the mainland.

So far, I have not seen a single camping site or shell heap which tends to contradict this view. I may be wrong, and others may, perhaps, be discovered, which disprove this view, but all those I have so far examined have been formed after Tasmania had acquired its present contours and physical features.

This is, in my opinion, a very important fact, because in conjunction with certain geological evidence it may tend to throw some light on the all-important question of age.

We know, and recent investigations have conclusively proved that the highlands of Tasmania were, geologically speaking, in very recent times, covered under vast sheets of ice. The exact area of this glaciation is not known yet, nor is it known to what height above sea level the ice reached. Prof. Gregory states that on the West Coast glacial deposits are found near Queenstown; the enormous boulder beds near Strahan are most probably of glacial origin. With all reserve, I venture to say that to judge from the present scanty evidence the glaciers extended to a much lower sea level in the Western than in the Eastern part of Tasmania. If we assume that all the land above 1,200-1,300 feet of the present level was covered under ice during the glacial period, I think we are well within limits. But even this moderate estimate leaves only a

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(1) A short calculation will easily prove this; assuming every member of a tribe of 50 persons consumes 50 oysters a day, not a very large allowance by any means, yet this would result in the daily production of 5000 valves, or 1,825,000 valves per year. Assuming that each valve weighs not more than 1 ounce (a very low *estimate*) this tribe would leave a refuse heap weighing 50 tons, being composed *of nearly* 2 million valves every year.

comparatively small area of the present island free from ice. It may further safely be argued, that if a large portion of Tasmania was covered under ice-masses of great thickness, this large quantity of ice must have had a considerable influence on the climate. Whatever view we take, that part of Tasmania which was not covered under ice was certainly much colder than it is now, and being in such close proximity to the glaciers, probably swept by icy-cold winds for the most part of the year. It was all but a hospitable and inhabitable region, in which those naked savages would have speedily perished had they been obliged to live in it permanently.

We can, therefore, take it as granted that the first population of Tasmania settled in the island after the disappearance of the glaciers, because all the camps and shell heaps hitherto discovered are situated within the arid, storm-swept and cold region above mentioned. According to information kindly supplied by Prof. Macaulay, Archæolithes have been found near the Great Lake on beds which are probably of glacial origin. Of course, these implements may have been left there long after the glacier had disappeared, but it is certain that they could not have come to their present resting place previous or during glaciation.

We have now gained another important step. We know that present Tasmania was uninhabitable for a primitive race like the Aborigines during the glacial period, and that their appearance may have either coincided with the melting away of the ice, or took place immediately after it. We also know that this immigration took place previous to the separation of the island from the mainland, and we therefore come to the very important conclusion that the island of Tasmania was separated from the mainland after the disappearance of the glaciers. The Eolithic-Archæolithic industry was, therefore, established in present Tasmania in post-glacial times.

Now, let us turn to Europe. The Eolithic-Archæolithic industry occurs in Europe chiefly in beds that are either of præ-glacial or glacial age. There is a great difference of opinion as to the duration of the glacial period in Europe, but on the whole geologists have agreed that the ice age terminated abut 10–12,000 years before our present era.

Now, if we assume that the diluvial ice age was synchronous all over the earth, the first immigration of human beings into Tasmania must have taken place about 10 to 12 thousand years before our present times, and the separation of the island from the mainland very shortly after that period.

This hypothesis raises at once another question. I have above mentioned that the main relics of the Eolithic-Archæolithic industry in Europe are found in beds of præ-glacial and glacial age. Under the assumption of the synchronism of the ice age they must, therefore, not only geologically but also absolutely be much older than those of Tasmania. Australia could therefore, not be considered as the cradle of mankind as some European scientists take her to be, but rather a kind of reservation in which the remains of those primitive tribes that inhabited Europe previous and during the ice age were preserved, thanks to her isolation from the main mass of the European-Asiatic Continent immediately after the termination of the ice age.

There are, however, a few objections to this hypothesis; the main is the assumption of the synchronism of the ice age. We have generally good geological reasons to assume that the diluvial ice age was synchronous all over the earth, but we have, so far, no absolute proof for this theory. Now, were we to assume that Tasmania and Europe were simultaneously populated by tribes using Eolithic-Archæolithic implements, it is evident that the glaciation of Tasmania must have commenced and terminated much earlier than that of Europe. The first immigration of human beings into Tasmania would then have taken place at a much more remote period than above assumed.

There remains another consideration which, in my opinion, is the weightiest of all. I have mentioned above that all the shell heaps and camping ground came into existence when Tasmania had already acquired its present physical features, in other words, its present shape. Now, supposing we were to assume that Tasmania was not only once connected with the mainland, but actually forms the last western remnant of a continent that once stretched far towards East, the habitability of Tasmania would at once take another aspect. We could assume, that although the western highlands were covered under ice, the more eastern parts were of a more temperate climate in which a primitive race could thrive.

When those last revolutions took place, which shaped the outlines of our present continents, the remainder of this race, which survived, was driven westwards, and settled in the country that had now become free of the bounds of ice, and which was formerly inaccessible to them. This hypothesis dispenses with the necessity of assuming that the glacial period existed in Tasmania at a much eariler date than in Europe, because it allows of an inhabitable region simultaneously with the glaciation of the other part. If we assume that in this region dwelt the race, the last remainder of which populated Tasmania, there is no necessity to suppose that the island of Tasmania became separated from the mainland of Australia after the disappearance of the glaciers. This separation may have taken place while the glaciers still existed.

The greatest objection against this hypothesis is the great depth of the sea between Tasmania and New Zealand, the bottom of which, for the greatest part, is more than 12,000 feet below sea-level. On the other hand, it would explain the modern look of the camping grounds. If we were to assume that the subsidences of the land between present Tasmania and present New Zealand took place very slowly, always submerging the older camping sites under the sea-level, gradually driving some of the tribes towards West; and if we assume that the last and final of these disturbances, which gave Tasmania its present shape, took place in comparatively recent times, say, about 2,500 years ago, this hypothesis overcomes all the difficulties which we meet when we assume that Tasmania was first populated about 12—10,000 years ago.

This theory seems to be rather a bold one, and few could grasp the idea that large geological disturbance can have taken place in comparatively recent times. Yet modern geology has proved that this was actually the case. England was not yet separated from the Continent, after the greater part of the great inland ice had disappeared. The Baltic Sea, which is now connected with the open ocean, formed a great inland lake, the so-called "Ancylus Lake," long after the ice had receded, and the bursting of that lake probably resulted in the great Cimbrian flood of which the Roman historians speak, and which set the tribes of the Cimbri and Teutones on their move towards Rome, whose terror they were for a long time, till they were finally defeated in 113 A.D. As there can be no doubt as to these great geological disturbances taking place in Europe, in geologically speaking, very modern times, there is no reason why we should not admit similar disturbances to have taken place in equally modern times in Tasmania. To sum up:

1. Present Tasmania became only inhabitable after the disappearance of the glaciers.
2. This disappearance can be fixed at about 10—12,000 years before our present era.
3. The primitive race that immigrated into Tasmania must have become isolated from the remainder of the world very soon after its immigration, otherwise it would have been wiped out long ago by a more energetic race.

4. If the immigration took place at so remote a period, the camping grounds could not present that modern look which they unquestionably have.
5. Is it probable that a race remained absolutely stationary for about 12,000 years, without advancing one step in civilisation, when in Europe it has practically only taken that time to reach our present stage?
6. The objections under 4 and 5 are so weighty that it is almost impossible to assume Tasmania has been inhabited by the Aborigines for any lengthy period.
7. The only hypothesis to get out of this difficulty is to assume, that though the ice may have disappeared at the time above stated, Tasmania was not inhabited till at a very recent date, and that the tribes which, at the time of glaciation, may have dwelt to the North and East, were driven to this formerly uninhabitable haven of refuge by geological disturbances taking place at very recent times, and resulting in the production of Tasmania's present outline.
8. The earliest date at which we could fix this is about 3,000 years before our present time, though, of course, the commencement of the geological disturbances may go back to a much earlier date.

Whichever view we take, two facts remain unrefutable: Present Tasmania became only inhabitable after the ice had disappeared, and the aboriginal population can only have moved into it after the melting of the ice, but previous to the present isolation of the island. The only question about which there can be a divergence of opinion is the question of fixing this time. If certain geological views be accepted, then the event of the first populating of the island may date back to a very remote period; but there is evidence to show that it cannot be dated earlier than 10—12,000 years, and probably not later than 3,000 years before our present times. (1).

For the present, we have to content ourselves with this result, but much remains still to be done in either proving or disproving it. In the first instance, the relationship of the camping sites to the glacial beds will have to be studied. In particular, it will have to be examined whether there really are no Archæolithes in beds of glacial age in Tasmania, and whether, as it now appears, the Archæolithes are strictly limited to the surface of the soil.

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(1) I may remark here that it seems a great pity that hardly any of the legends of the Aborigines have been collected, at least not to my knowledge. As it is unquestionable that they witnessed great geological changes, the recollection of these terrible events must have impressed itself so vividly in the mind of the survivors that it is fair to assume that it was handed over to future generations in the shape of legend.

The cave deposits which most certainly exist in Tasmania will have to be examined, and the question whether there is any relationship between the extinct fauna occuring on King's Island, and the former inhabitants will have carefully to be gone into.

After all these questions have been studied and decided one way or other, we will be in a much better position to settle the antiquity of the Eolithic-Archæolithic civilisation in Tasmania. In the mean time our most urgent duty is to collect as much information about the occurrence of the relics of a race that became extinct within the memory of the present generation, or else a time will come when it is again "too late," and a future generation will blame us for our omissions.

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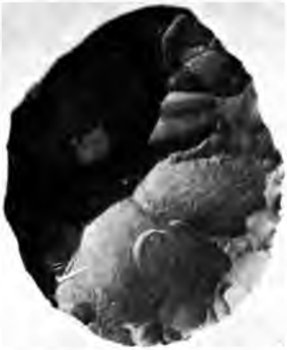

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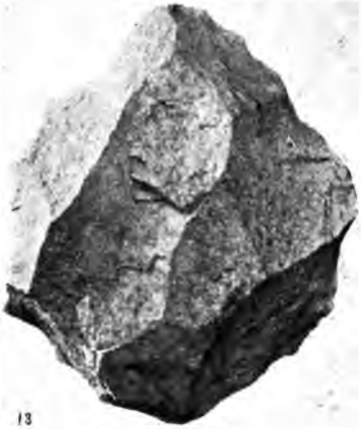

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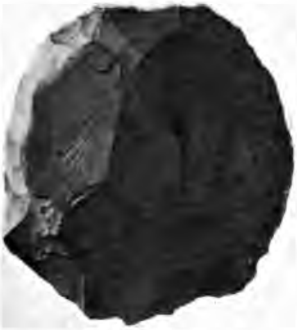

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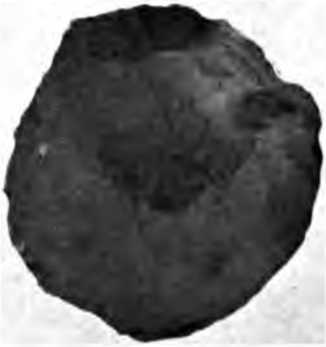

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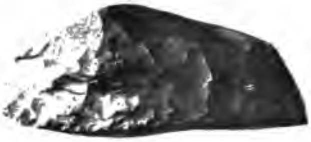

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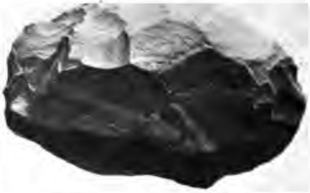

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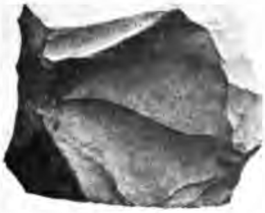

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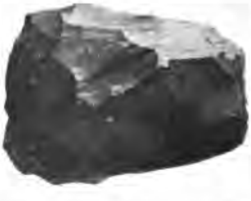

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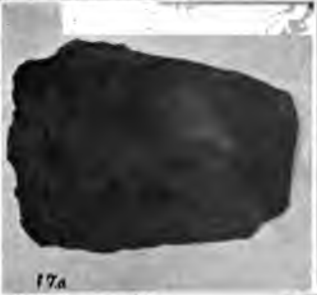
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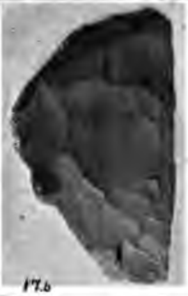
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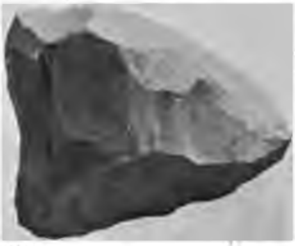
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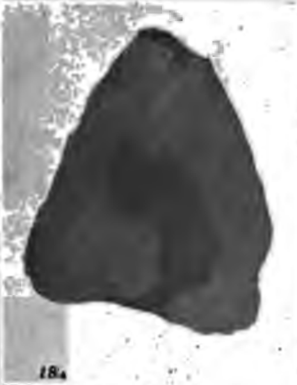
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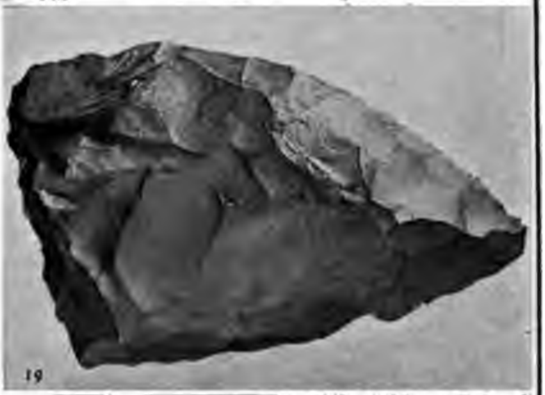
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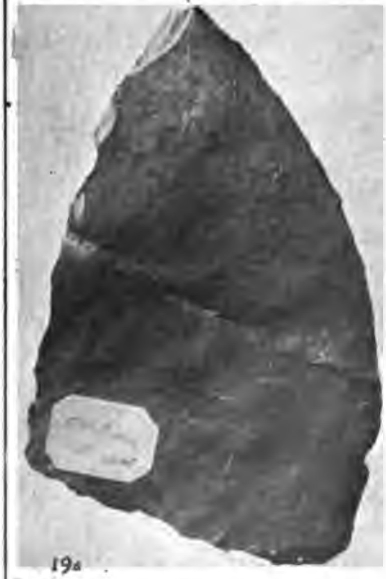
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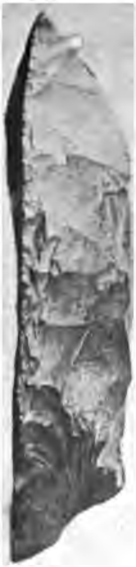
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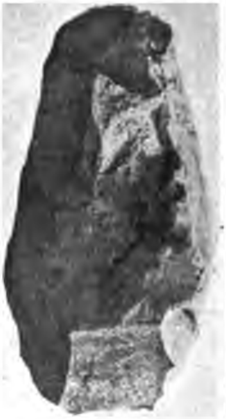
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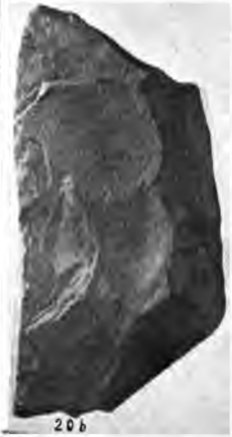

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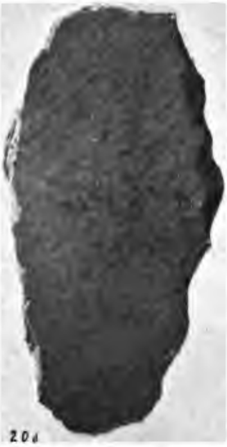

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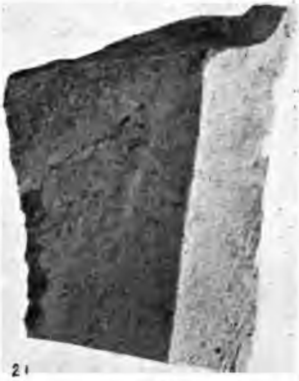

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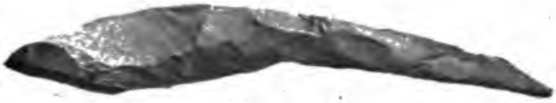

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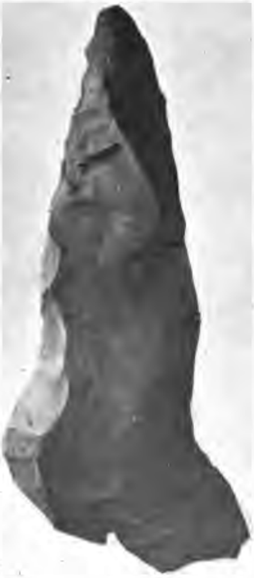

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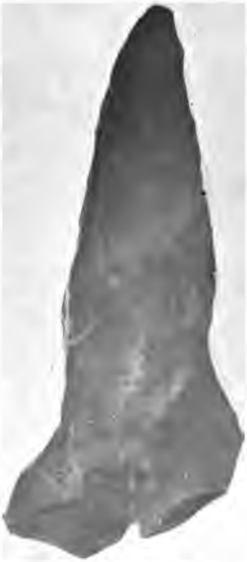

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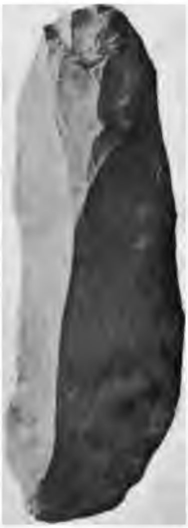

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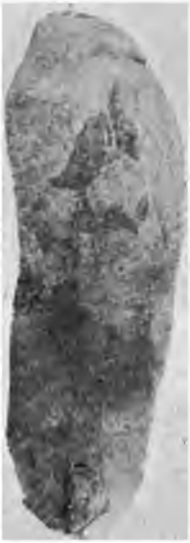

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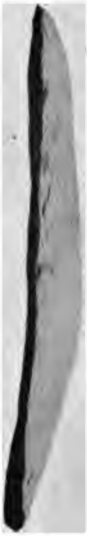

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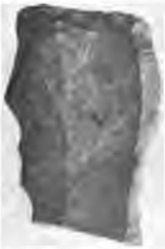

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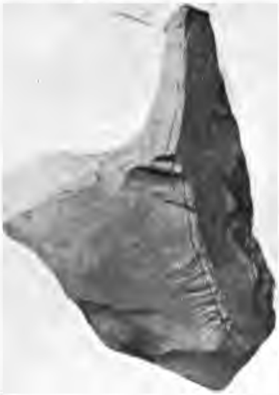

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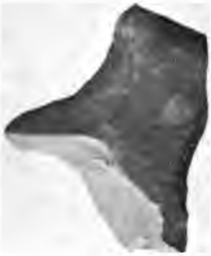

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